Vol. 9, No. 2 FEBRUARY, 1954

AGRICULTURAL CHEMICALS

In This Issue:

Man vs. Insects • Insecticide-Fertilizer Mixtures • TVA '53 Report • Use of Isotopes in Fungicide Research • Cotton States Branch ESA Meets • Herbicidal Development • Research in Fertilizer Manufacture • '53 AC Index

Quality* INSECTICIDES

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- ***FINENESS**—ALL POWCO BRAND insecticide powders are reduced to micron-size particles by high powered precision equipment. This insures the dusting qualities you need for maximum insect control.
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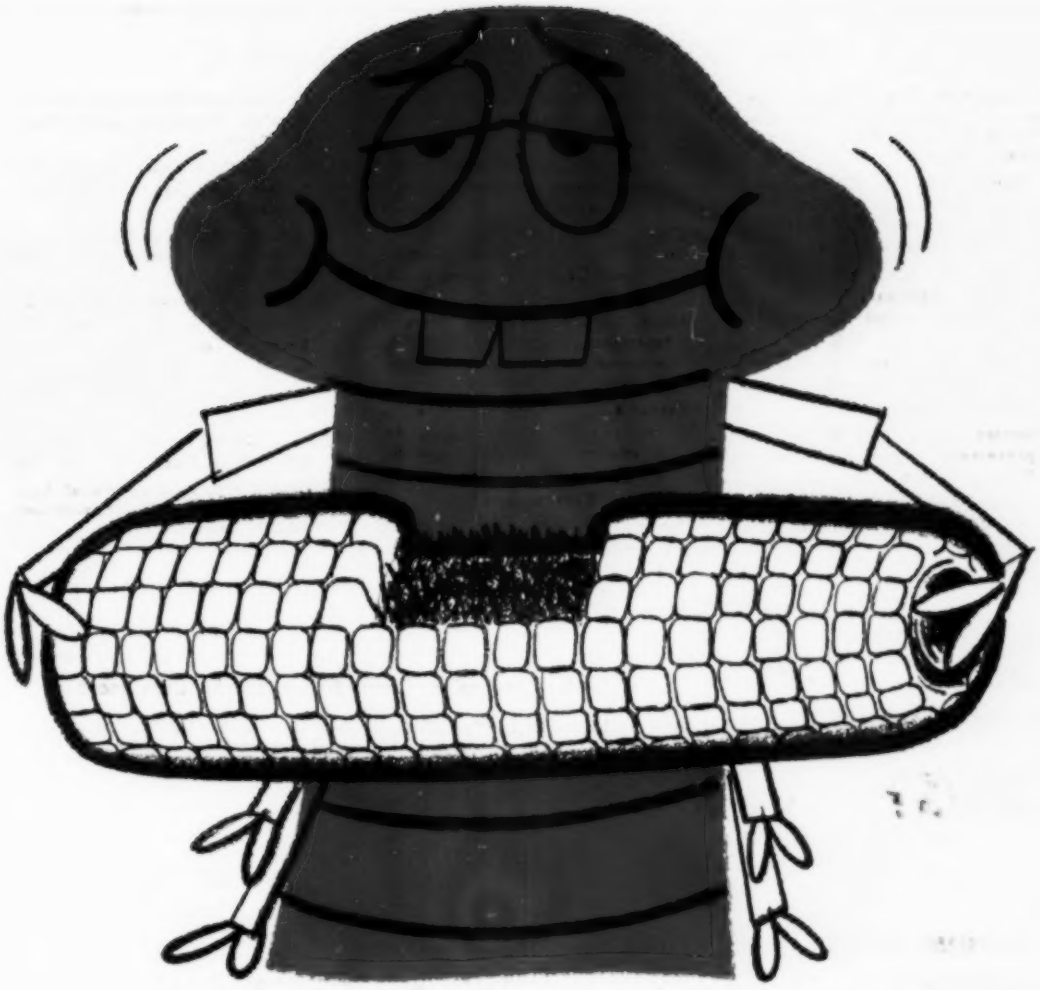

Last meal for him . . . new horizons for you . . . in Attaclay

Carriers for soil pesticides

We are leaders in developing granular grades for soil pesticides, herbicides and fungicides. Write for samples and for your copy of our latest report on this promising field.

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INDUSTRY MEETING CALENDAR

February 9-10 — Raw Products Conference, Production of Vegetable Crops. N.Y. State Experiment Station, Geneva.

February 11-12 — Ninth annual Crops, Soils and Fertilizer Conference. Student Union, Oklahoma A. & M. College, Stillwater.

February 17-19 — Mid-Western Chapter, National Shade Tree Conference, LaSalle Hotel, Chicago.

February 19 — Canadian Agricultural Chemicals Assn., Royal York Hotel, Toronto.

February 19 — Midwest Soil Improvement Committee, Palmer House, Chicago.

February 23-25 — Plant Pest Control Conference of the Agricultural Experiment Station of the Alabama Polytechnic Inst., Auburn, Ala.

March 2-4 — Eighth annual Pest Control Operators Short Course, Pennsylvania State College, State College, Pa.

March 7-9 — Fertilizer Section, Southern Safety Congress, Louisville, Ky.

March 8-10 — Fertilizer Section, American Institute of Chemical Engineers, national meeting, Statler Hotel, New York City.

March 8-12 — Annual Meeting, American Mosquito Control Association, Inc., Atlantic City, N.J.

March 22-24 — Western Weed Conference, Tucson, Ariz.

March 24-26 — National Agricultural Chemicals Association Spring Meeting, Shamrock Hotel, Houston, Texas.

March 24-27 — American Chemical Society, Municipal Auditorium, Kansas City.

March 25-26 — North Central States Branch ESA, Hotel Paxton, Omaha, Neb.

June 10-13 — American Plant Food Council, The Homestead, Hot Springs, Va.

June 14-16 — National Fertilizer Association, Greenbrier Hotel, White Sulphur, W.Va.

June 22-24 — Pacific Slope Branch, E.S.A., Pilot Butte Inn, Bend, Ore.

September 8, 9, 10—National Agricultural Chemicals Association, Spring Lake, N.J.

WORRIED ABOUT FERTILIZER PRODUCTION

COSTS?

The fertilizer sales picture today calls for the closest attention to reducing production costs. It requires higher efficiency in formulating all mixed goods.

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AGRICULTURAL CHEMICALS

This Month's Cover

"Something old—something new." "Krilium" soil conditioner and "Folium" water-soluble fertilizer have been members of Monsanto Chemical's "home garden" line for several seasons. New to the line this year are "D-Leet" herbicide and "Bogey" all-purpose pesticide. Also Monsanto's new plastic applicator for "Folium."

FEBRUARY 1954
Vol. 9 No. 2

A Monthly Magazine For the Trade

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Entered as second-class matter November 4, 1949, at the Post Office at Baltimore, Md., under the Act of March 3, 1879.

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GENERAL CHEMICAL'S "STA-FRESH*" Sodium Bisulfite

THE BEST YET FOR KEEPING GRASS SILAGE FRESH, GREEN AND SWEET SMELLING

"STA-FRESH" is General Chemical's remarkable new Silage Grade Sodium Bisulfite that keeps grass silage fresh, bright green and sweet smelling. Now—after two years of excellent results in extensive "on the farm" tests, General Chemical is making this easy-to-use, low-cost powder available to dairymen and livestock raisers everywhere.

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At rates varying from 8 to 10 pounds per ton, "STA-FRESH" has been used successfully on a variety of forage crops, including alfafa, brome grass, orchard grass, ladino clover, sweet clover, timothy, vetch, oats and corn. "STA-FRESH" is easy to use—the powder is added as the crop is blown into the silo.

Write for Free Information Bulletin

"STA-FRESH" insures the farmer a more palatable silage with higher food value . . . it takes less work and costs less to prepare. From its vantage point of over fifty years as a producer of Orchard Brand agricultural chemicals, General Chemical believes that "STA-FRESH" is an outstanding contribution to the grass farming program.

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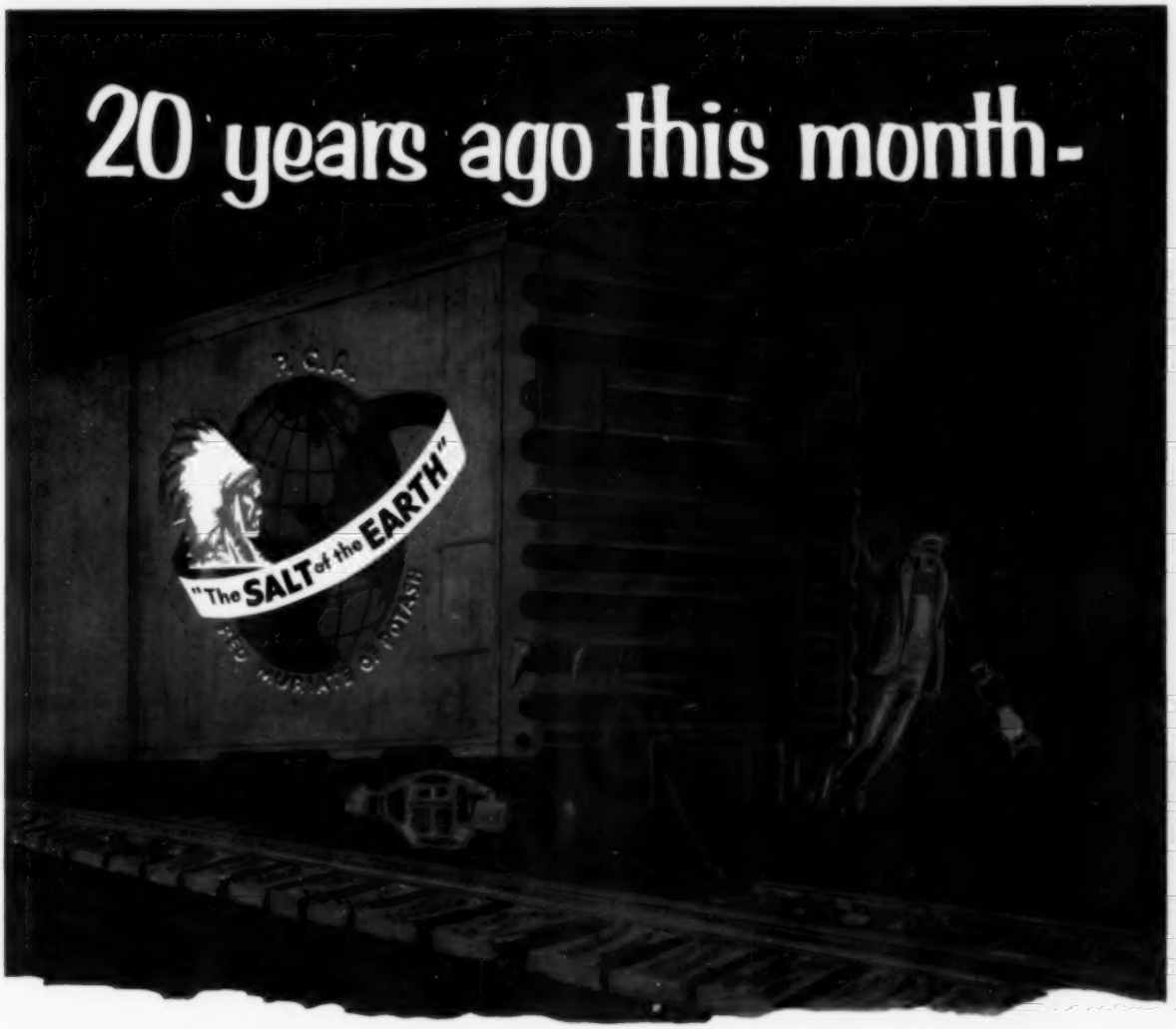

Yes, twenty years ago in this month of February, we made our first commercial shipment from the mine near Carlsbad. Because of

- ✓ **Unparalleled service to our customers**
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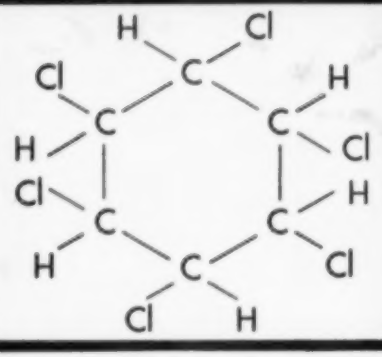

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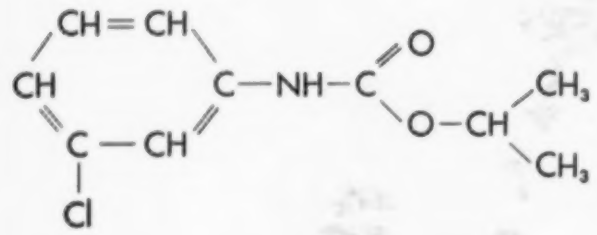

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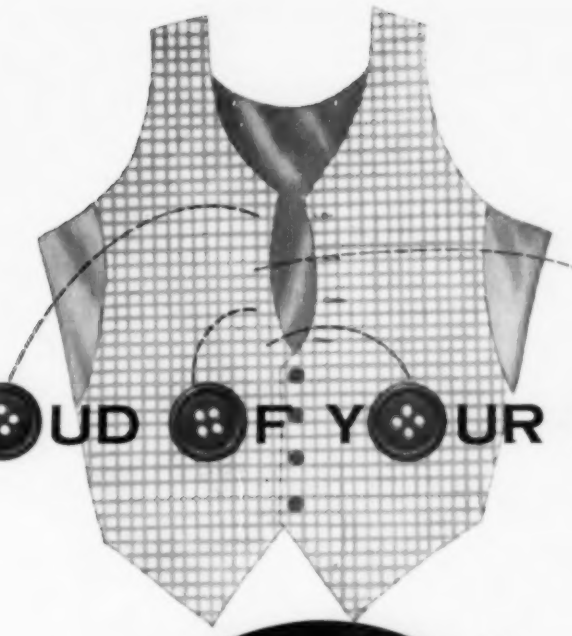

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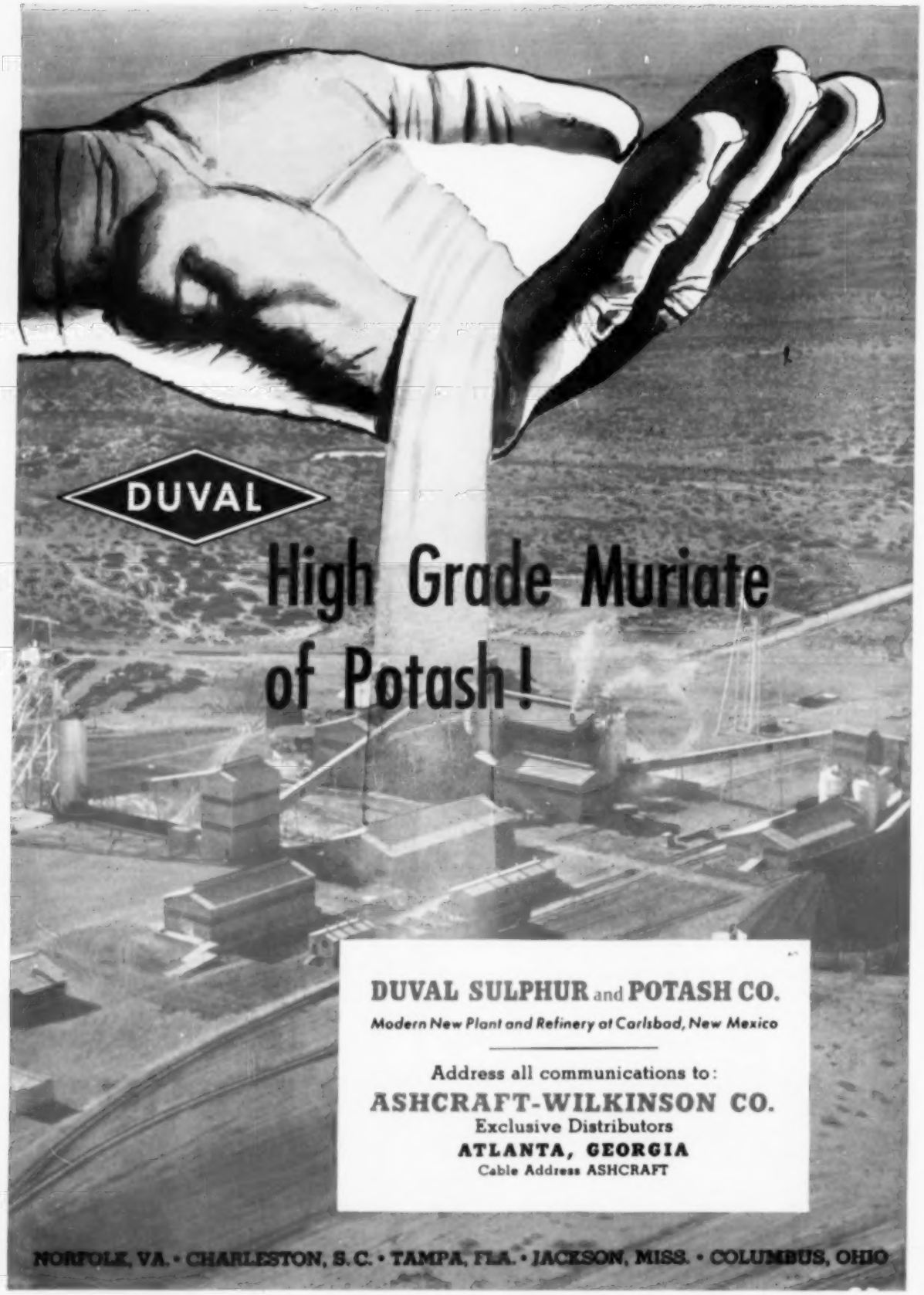
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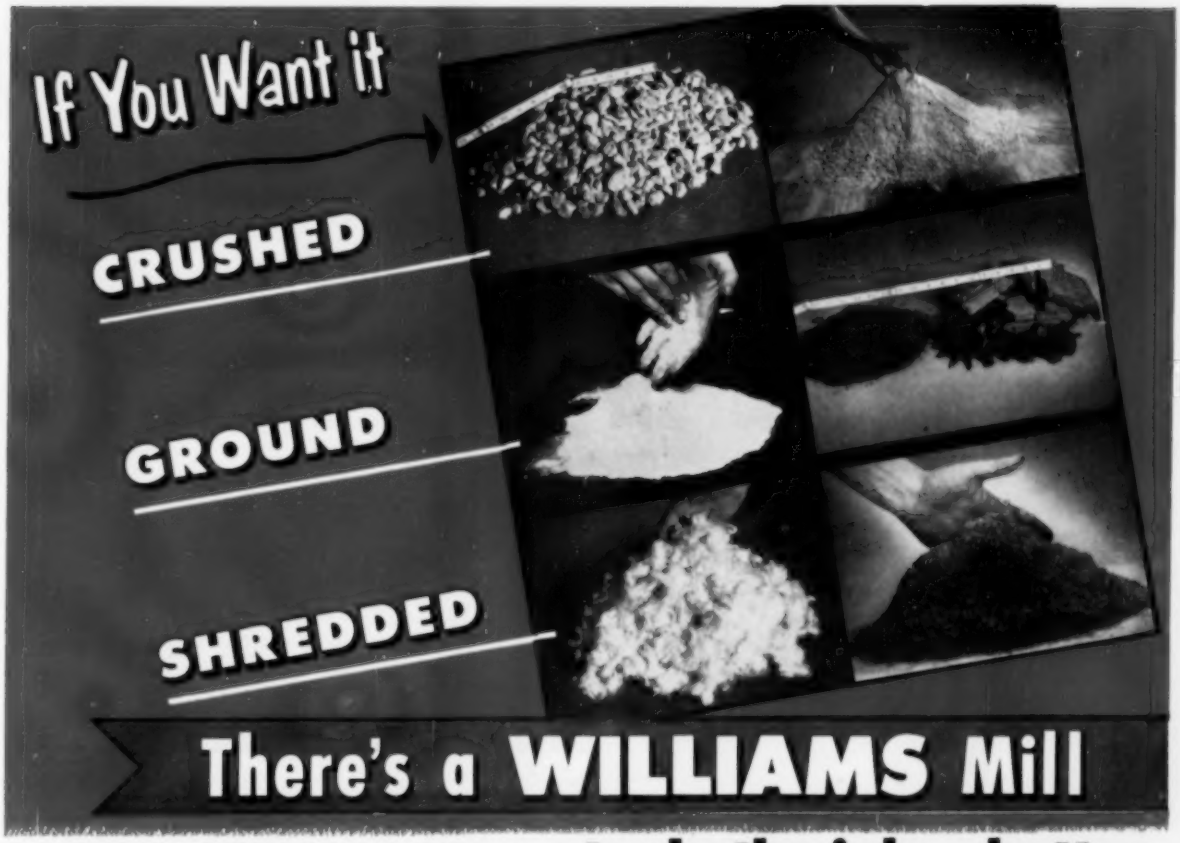

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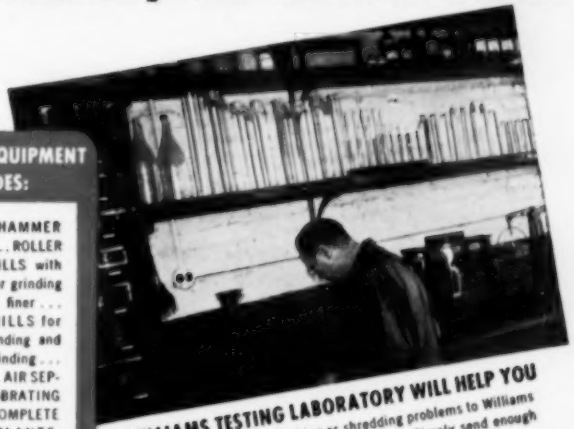

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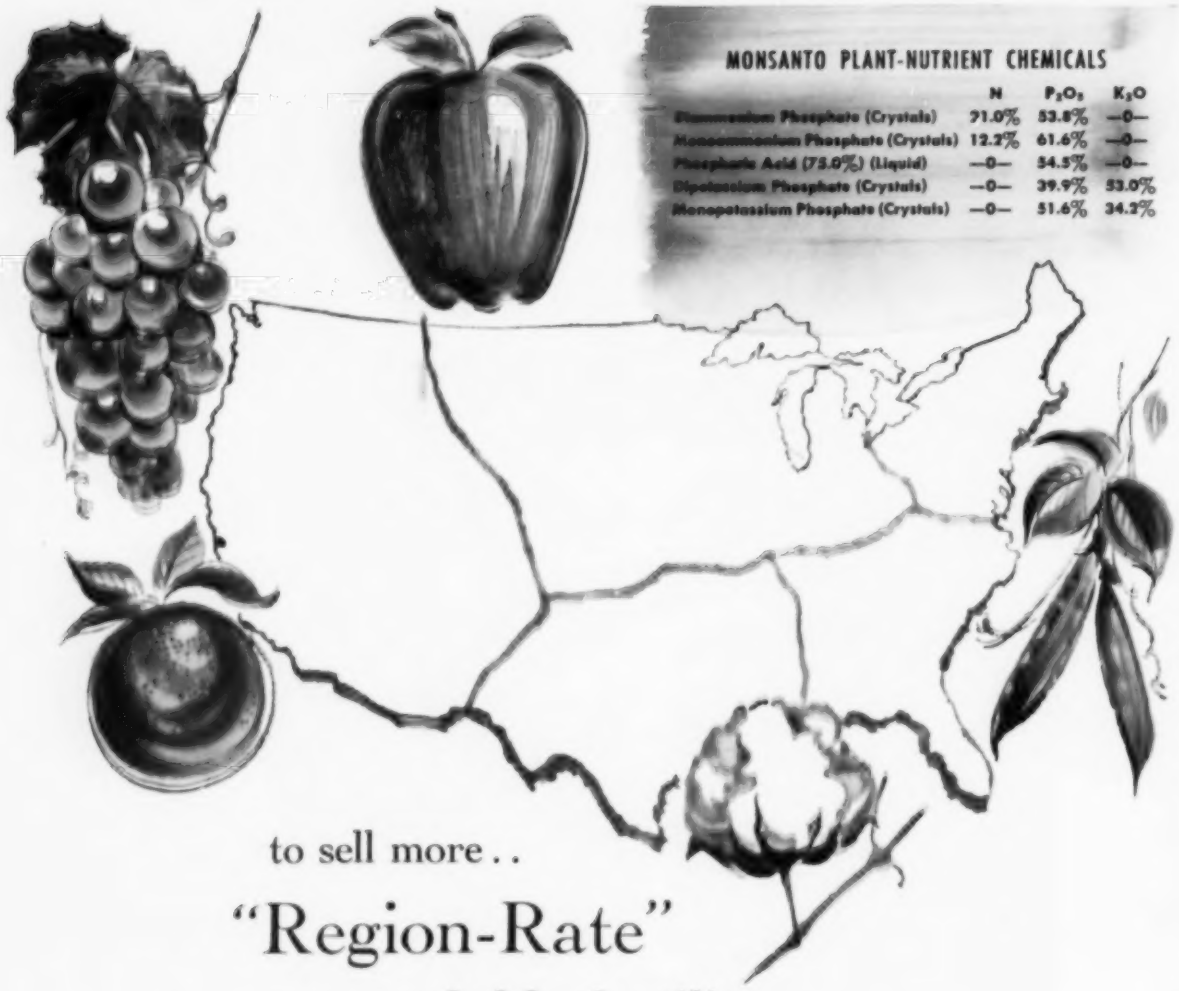

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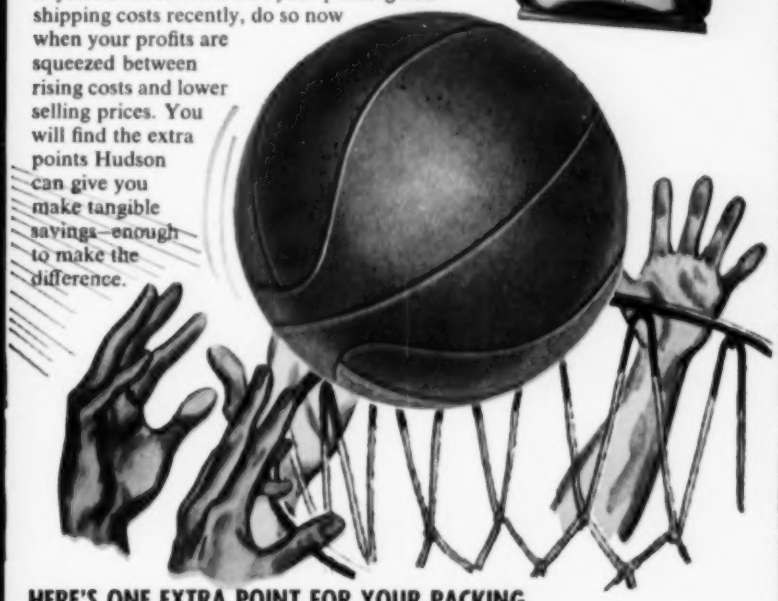
With multiwall sacks, too, strong contenders are matched to excel in supplying your needs. There are differences between their services and their sacks which, taken individually, may seem small. But over the whole season, these extra points are enough to make the difference.

If you haven't checked on your packing and shipping costs recently, do so now when your profits are squeezed between rising costs and lower selling prices. You will find the extra points Hudson can give you make tangible savings—enough to make the difference.



HERE'S ONE EXTRA POINT FOR YOUR PACKING

. . . Hudson's 39-point Inspection and Test Program

From tree planting to finished sacks, Hudson controls and supervises the production of your multiwall sacks. With no less than 39 inspection and testing steps along the production line, Hudson has gone well beyond the call of duty to make certain the sacks you get will perform to your complete satisfaction. Because of this thorough testing, Hudson can give you a written guarantee of satisfaction. See for yourself the complete story of how Hudson multiwalls are produced. Send the coupon below for the book on how Hudson sacks are made, inspected and guaranteed. Illustrated with over one hundred action photographs.

HUDSON PULP AND PAPER CORP.
DEPT. AC-2, 505 Park Avenue
New York 22, N. Y.

Yes! We'd like a copy of the profusely illustrated free book on Hudson multiwall sacks, and details on the Hudson guarantee.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

Offices from coast to coast—Write 505 Park Avenue, New York 22, for nearest district sales office.

Results count

whether you buy or sell

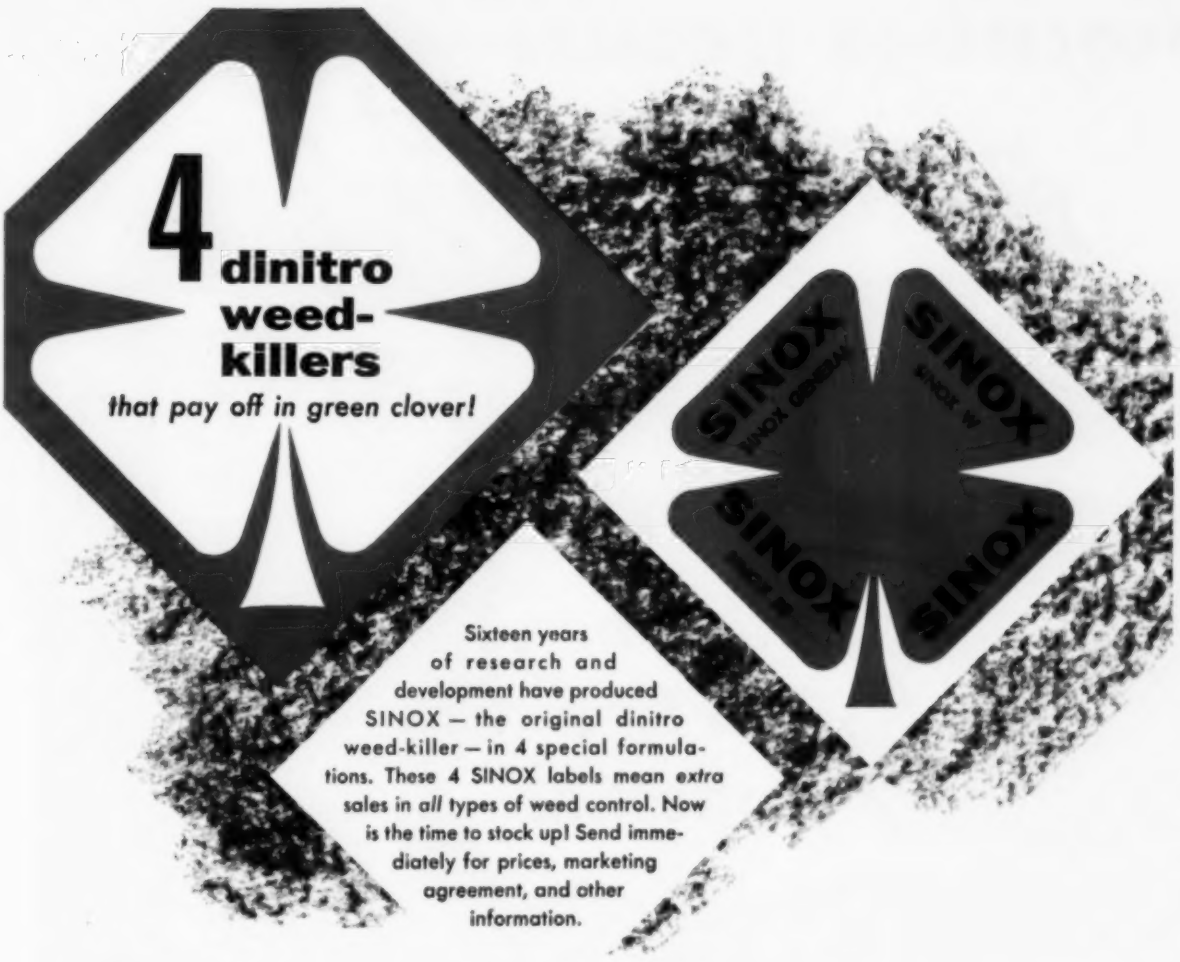
The farmer who buys fertilizer wants good results from every sack of fertilizer he buys – that's what builds his profits. Manufacturers, such as yourself, are equally anxious for consistent and uniform results because that's how you build a repeat business – and that's what builds *your* profits. Uniformity is an important factor to you and to the farmer. It's ***enough to make the difference!***

Uniformity is also important in the Multiwall Sacks you use to package your product. Sacks that are consistently uniform can mean triple savings for you – savings in machine time – savings in labor – savings in material.

Hudson Multiwall Sacks are guaranteed to be uniform. Every sack you buy is just like every other one – no need to stop production for machine adjustment. Hudson's 39 point test and inspection program assures satisfaction. Investigate Hudson Multiwalls and see how uniformity can save your money.

Check over this list of 100% services that Hudson Multiwall Sacks offer you.

Mail the coupon on the other side of this page for complete information.


4 dinitro weed-killers
that pay off in green clover!
SINOX
SINOX
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Sixteen years of research and development have produced SINOX — the original dinitro weed-killer — in 4 special formulations. These 4 SINOX labels mean extra sales in all types of weed control. Now is the time to stock up! Send immediately for prices, marketing agreement, and other information.

weed control:	check these 4 SINOX uses	
selective	SINOX	For safe selective weed control in onions, flax, and grain.
	SINOX W	For selective spraying of seedling alfalfa, onions, flax, and grain.
pre-emergence	SINOX PE	For pre-emergence spraying of cotton, beans, corn and peas; early summer treatment of alfalfa and clover.
pre-harvest	SINOX GENERAL	As a desiccant for Seed Alfalfa, Clovers, Sudan Grass, Milo, Flax and Peas — Also used as a chemical weed mower in orchards, vineyards, ditches, etc. — Potato Vine Killing.

OTHER STANDARD AGRICULTURAL PRODUCTS

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STANTOX "64"— *2,4-D Amine Salt*
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STANTOX "T-45"— *2,4,5-T Ester*
STANTOX "22" BRUSH KILLER
Low Volatile Esters of 2,4-D, & 2,4,5-T
STANTOX "LV-45"— *Low Volatile 2,4,5-T Ester*
STANTOX "SODIUM TCA"— *(90%)*
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DORMANT FRUIT SPRAYS

ELGETOL
ELGETOL "30"
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TOXAPHENE EMULSION
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PARATHION EMULSION
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AND OTHERS.

Standard Agricultural Chemicals, Inc.

1301 Jefferson St., Hoboken, N. J. • 429 Forum Building, Sacramento, Calif.

PROCESSING TROUBLES puzzling you?

Solving any puzzle is more easily achieved if key parts can be determined first. As a carrier and diluent for insecticides, fungacides, sprays and dusts, Diluex and Diluex A exceed the most exacting qualifications of the agricultural chemical industry.

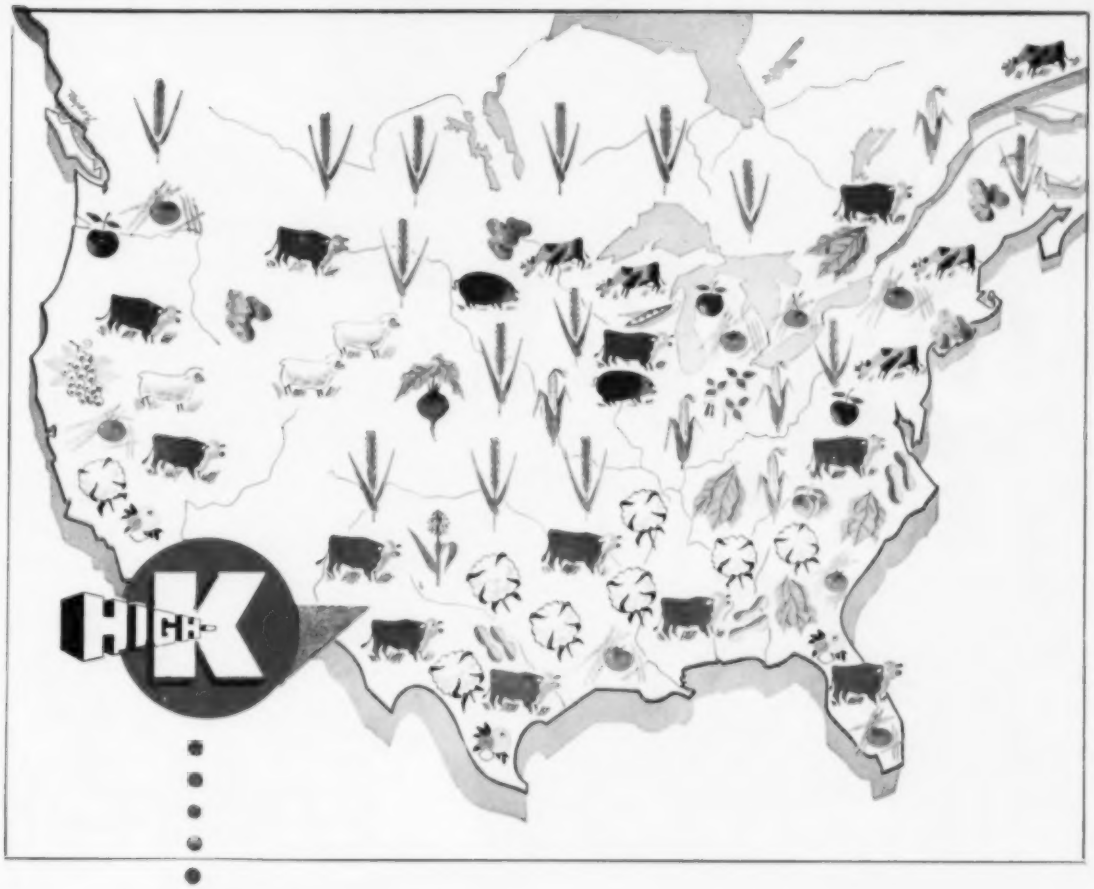
Diluex and Diluex A are basically an aluminum magnesium silicate mineral, having an amphibole-like structure possessing a large adsorption capacity in liquid impregnation procedures used in processing the newer complex organic insecticides. Both products are widely accepted as superior grinding or milling aids for technical grade toxicants such as DDT and BHC and will discharge readily from commercial dust applicators giving uniform coverage and minimum fractionation of toxicant and carrier in the swath.

Write for complete specifications and samples; our technicians are available to to help solve your processing troubles.

FLORIDIN COMPANY

. . . ADSORBENTS . . . DESICCANTS . . . DILUENTS . . .

Dept. M, 220 Liberty Street, Warren, Pa.



Southwest serves agriculture

...by using modern mining facilities and up-to-date processes to produce HIGH-K* Muriate of Potash for plant food manufacturers.

Southwest Potash Corporation

HIGH-K Potash

*Trade-mark

61 BROADWAY ★ NEW YORK 6, N. Y.

only ORTHO Lindane* gives you all these advantages:

1) Guaranteed Gamma

—minimum pure gamma isomer 100%. ORTHO Lindane assures you of true Lindane quality actually higher than minimum Government requirements for pure Lindane.

2) Easy Formulations

—easily handled—easily formulated as a spray or dust. ORTHO Lindane crystal particles are dry, free-flowing. Easily ground to micro-size.

3) Stability

—chemically stable.

4) Manufacturing "Know-How"

—made exclusively by the original manufacturers of Lindane in the U.S.A.

T.M. REG. U.S. PAT. OFF.: ORTHO

* *ORTHO* Lindane is a truly amazing insecticide offering high potency, rapid action, and residual control. Kills more than 200 varieties of insects by contact, vapor action, and stomach poison.

always—you profit with ORTHO

For complete information, "Story of Lindane," write:

CALIFORNIA SPRAY-CHEMICAL CORP.

Linden, N. J.	Goldsboro, N. C.	Whittier, Calif.
Maryland Heights, Mo.	Shreveport, La.	Fresno, Calif.
Fennville, Mich.	Orlando, Florida	San Jose, Calif.
Oklahoma City, Okla.	Caldwell, Idaho	Sacramento, Calif.
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Home Office: Richmond, California

World leader in scientific pest control

ORTHO

when it comes to weed and brush killers...

are a formulator's best friend

For information on costs, technical service and other details, write to:

DIAMOND ALKALI COMPANY

DIAMOND ALKALI CHEMICALS

Organic Chemicals Division
80 Lister Avenue • Newark 5, New Jersey
Plants: Newark, N. J. and Houston, Texas

Produce Superior Field Strength INSECTICIDES

with . . .

the RAYMOND *Whizzer Equipped* IMP MILL

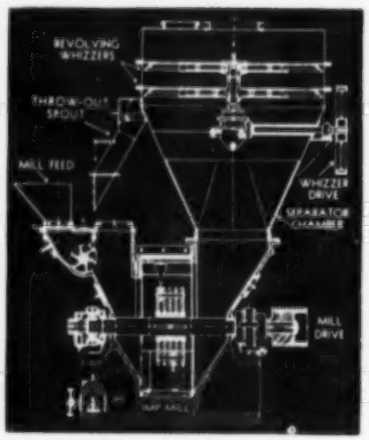
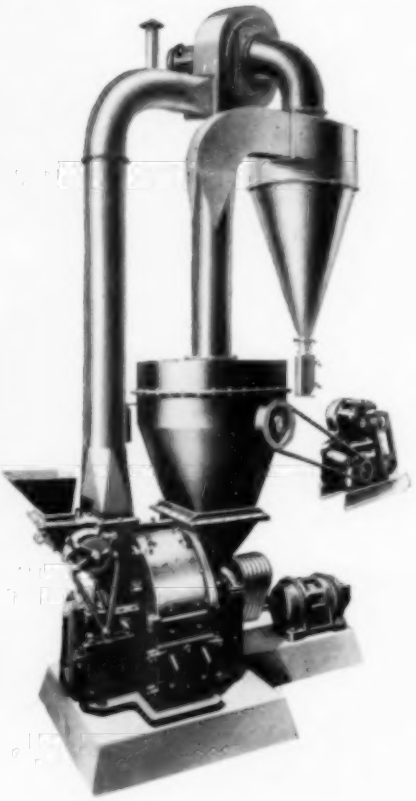


Diagram shows large separating chamber and revolving whizzer blades for maximum efficiency in blending and classifying fine powders.



RAYMOND IMP MILL

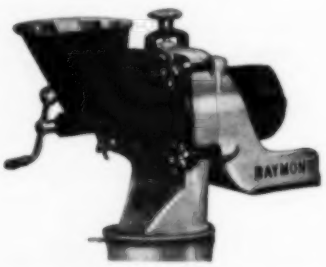
showing Whizzer Separator with independent variable speed drive.

THE Raymond Imp Mill with Whizzer Separator offers special advantages for grinding, blending and classifying field strength insecticide formulations.

- (a) Clean, dust-free, automatic system
- (b) Compact and flexible installation
- (c) Air separation for classifying and conveying also provides a cooling medium for the mill system
- (d) Whizzer control gives wide range fineness with a simple adjustment
- (e) No screens to break, clog, wear out
- (f) Economical operation and maintenance

Many modern plants are using the Raymond Imp Mill for producing uniform powders and mixtures of DDT, BHC, Toxaphene, Chlordane and other formulas at new low costs.

For full details of Raymond insecticide grinding mills, write for New Bulletin # 68.



RAYMOND LABORATORY MILL

For grinding small lots of materials and making test runs. Write for Bulletin No. 55

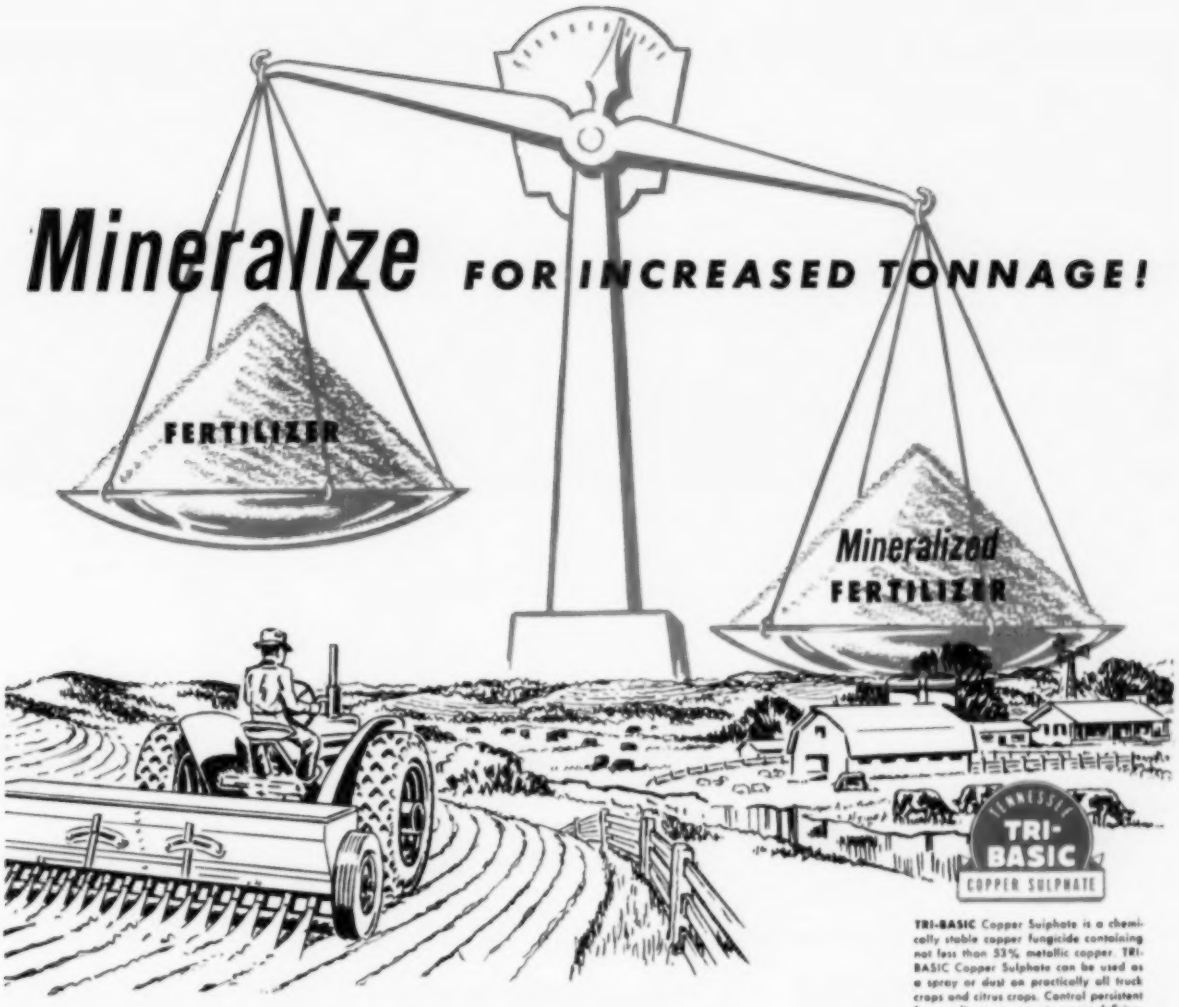
COMBUSTION ENGINEERING, INC.

Raymond Division

1314 NORTH BRANCH ST., CHICAGO 22, ILLINOIS

SALES OFFICES IN PRINCIPAL CITIES

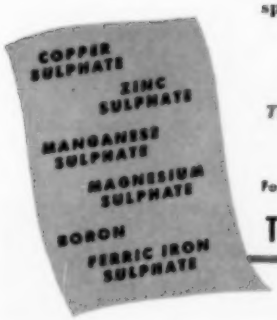
Mineralize FOR INCREASED TONNAGE!



Growers of today realize more and more the necessity of minerals in the soil if they are to realize optimum production. They are buying more mineralized fertilizer because the results have proven conclusively these fertilizers produce greater yields. The addition of minerals to your fertilizer will stimulate sales and create new business through the growers' increased yield of vitamin-rich crops.

As basic producers of minerals we would like to discuss with you the advantages of mineralized fertilizers and how you can step up your fertilizer tonnage and profits through the addition of minerals.

With the Tennessee Corporation as your supplier, you are sure of uniform high quality and personal attention to specific needs.



SOLUBLE TRACE MINERALS

Tennessee's trace minerals are soluble and their nutritional value is immediately available to the plant. Soluble trace minerals are more economical and faster acting.

For detailed information, phone, wire or write—

TENNESSEE TC CORPORATION

617-29 Grant Building, Atlanta, Georgia

TENNESSEE TRI-BASIC COPPER SULPHATE

TRI-BASIC Copper Sulphate is a chemically stable copper fungicide containing not less than 53% metallic copper. TRI-BASIC Copper Sulphate can be used as a spray or dust on practically all truck crops and citrus crops. Control persistent fungus diseases—correct copper deficiencies from a nutritional standpoint. Use TC TRI-BASIC Copper Sulphate.

COP-O-ZINC NEUTRAL COPPER ZINC

COP-O-ZINK is a new, neutral copper-zinc fungicide containing 42% copper and 11% zinc. COP-O-ZINK gives a superior performance in control of fungus diseases. COP-O-ZINK composition of two essential elements gives it added value in correcting deficiencies of zinc and copper and in stimulating plant growth. COP-O-ZINK is compatable with all inorganic and organic insecticides. No lime is required. For use in spraying or dusting.

NU-Z NUTRITIONAL ZINC

NU-Z contains 52% metallic zinc. It is a neutral zinc compound which does not require the addition of lime for direct foliage application. NU-Z gives excellent coverage and adherence to plant foliage, thus rendering it available over a longer period of time. Safe for direct application. For zinc deficiency and plant nutrition—use as a spray or dust.

Here's the home of Howe, Incorporated, in Minneapolis, Minnesota. Serving the area of Minnesota, the Dakotas and Wisconsin, Howe produces quality high analysis mixed fertilizers; also formulates and distributes insecticides and fungicides.

President and Treasurer of Howe, Incorporated, is Roy M. Howe, who organized the firm in 1940.

Howe, Incorporated

...Another Spensol User

Millions of dollars worth of highly specialized equipment is needed to produce SPENSOL (Spencer Nitrogen Solutions).

Dependable service has made SPENSOL a favorite with leading mixers. Tank cars like this are a common sight on their tracks.

This new spray pipe with deflecting nozzles was invented by a Spencer man, H. B. Davis. Perhaps our Technical Service staff can solve your problem.

SPENCER

SPENCER CHEMICAL COMPANY, Dwight Bldg., Kansas City 5, Mo. District Sales Offices: Atlanta, Ga.; Chicago, Ill.; Memphis, Tenn.; Works: Pittsburg, Kans.; Henderson, Ky.; Chicago, Ill.; Vicksburg, Miss.; Orange, Texas (under construction)

America's Growing Name in Chemicals

This chain WON'T break

Here are chains especially designed for bucket elevator service that properly applied, *will not break!*

Rex Chabelco® S-856 and S-858 Steel Chains may *wear* out after long, tough service, BUT they won't break. And, you'll be able to free men for other important tasks...not have them on continuous elevator maintenance work. You'll get greater production...eliminate chain replacement costs.

These elevator chains have extra-large bearing areas in contrast to other types of chain used in this demanding service. They will outlast...outwear any other chain because they are built for bucket elevators.

Defeat chain breakage and all the extra cost it causes you by standardizing on Rex Chabelco S-856 and S-858 Chains for your bucket elevators. Your Chain Belt Field Sales Engineer will be happy to give you the complete story. Or, mail the coupon.

CHAIN BELT COMPANY

District Sales Offices and Distributors in all principal cities

CHAIN BELT COMPANY 54-113
4795 W. Greenfield Ave.,
Milwaukee 1, Wis.

I want the story on Rex Chabelco S-856 and S-858 Chains. Send me my copy of Bulletin No. 52-53.

Name.....

Company.....

Address.....

City.....*Zone*....*State*.....

You can't compete if your equipment is obsolete!

With business conditions more competitive, it is more important than ever to analyze your production costs . . . your handling methods . . . your tools and equipment.

Obsolete methods and equipment take a heavy toll by slowing down production, increasing manhours and increasing repairs and maintenance. Material handling equipment in many plants is the key factor in efficient production — the pace setter for the entire plant. That is why it is so important to keep raw materials *on the move* in and out of the plant, to and from processing machinery — with the most modern, efficient methods and equipment.

If you are not using "PAYLOADER" Tractor-Shovels at present, it will pay you to investigate this fast, flexible, versatile system that is producing outstanding economies in all sizes of plants throughout the nation.

If your plant is already "PAYLOADER"-equipped, you'll be pleasantly surprised at the superior performance of the late model "PAYLOADERS". Although "PAYLOADERS" are built for years and years of dependable service, constant research and engineering improvements keep "PAYLOADERS" out in front in design, construction and performance.

Now is the time to trade in obsolete equipment — to gear your plant to present day conditions — to assure profitable operation on existing or slightly lower sales volume. Your nearby "PAYLOADER" Distributor will be glad to discuss your material handling methods and provide a demonstration of this equipment. For his name and address write The Frank G. Hough Co., 743 Sunnyside Avenue, Libertyville, Illinois.

PAYLOADER®

THE FRANK G. HOUGH CO. • Since 1920

UNION SPECIAL*

Here's dependable, high speed bag closing . . .

Photo above shows a high production installation of a Union Special Class 30500 Bag Closing machine in a fertilizer plant.

Send for this New Bulletin

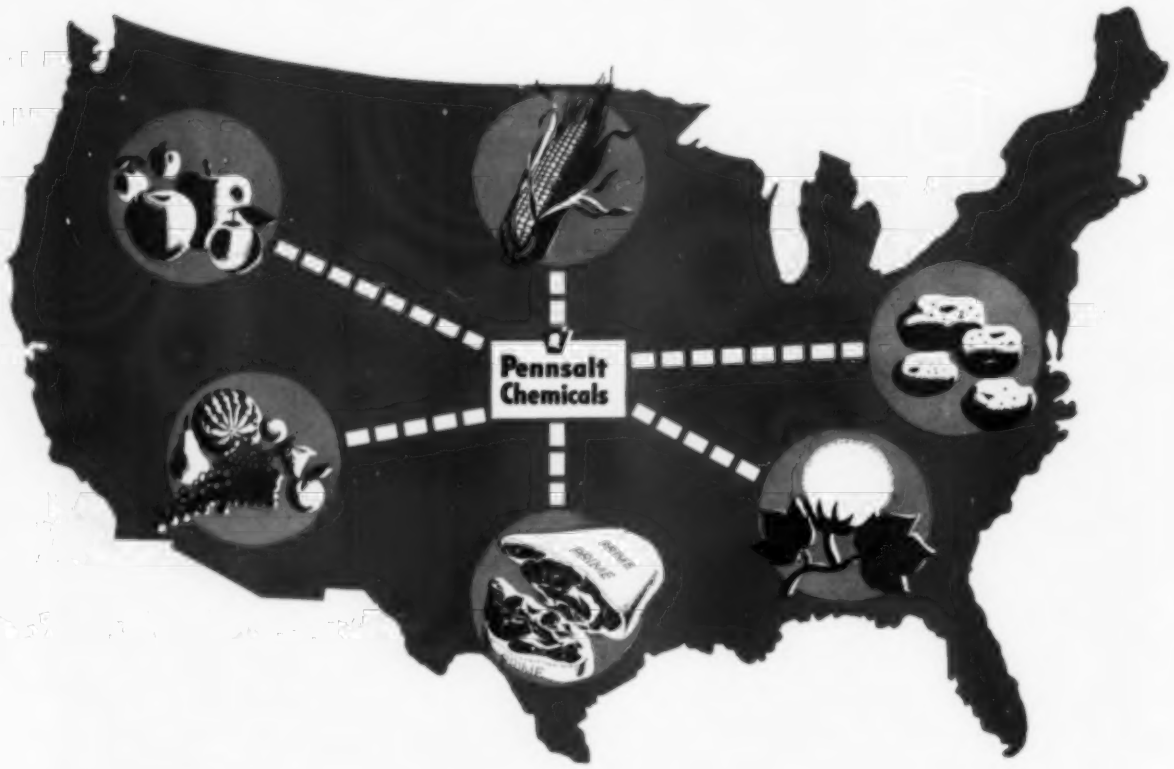
Use this new 16 page illustrated bulletin to quickly select the right machine for the job. Contains complete data on sewing heads, columns, conveyors, accessories, and overall dimensions plus more than fifty illustrations of machines, plant installations and types of closures. Write for your copy now.

. . . to help you cut costs in your plant!

At today's high operating costs, you can't afford to have inefficient production methods in your plant. That's why it pays to take advantage of Union Special's faster, more dependable, more economical bag closing equipment. Union Special bag closers give you *more* production . . . per man . . . per hour because every Union Special is engineered and built with your basic requirements in mind — to do a specific bag closing job at lowest possible unit cost. For recommendations, see your local Union Special representative or write UNION SPECIAL MACHINE CO., 447 N. Franklin St., Chicago 10.

*®

BAG CLOSING MACHINES



Serving from coast to coast —

You'll find Pennsalt's ***Penco Brand*** Agricultural Chemicals on the farm fronts from coast to coast.

Penco sprays help protect the fruit crops and the forests of the big northwest. In Maine and Idaho better potatoes grow with the aid of Penco potato insecticides. From California to the Carolinas cotton quality is improved by the use of Penco cotton insecticides and defoliants. In the middle West, Penco herbicides help produce weed-free crops and livestock producers depend on Penco dips and sprays. In short, you'll find Penco products practically everywhere.

In addition, Pennsalt Laboratories continually work toward further improvement in the products they offer to agriculture and to you.

For information on prices and delivery, or technical assistance, write Agricultural Chemicals, Pennsylvania Salt Manufacturing Company of Washington, Tacoma, Washington • Philadelphia 7, Pa. • Montgomery, Ala. • Bryan, Texas • Portland, Oregon • Los Angeles and Berkeley, California.

Pennsalt Chemicals

PENNSYLVANIA SALT MANUFACTURING COMPANY OF WASHINGTON

This month United States Steel ads recommend high-nitrogen fertilizers to

1,547,000 Farmers!

Pasture yield raised 33%
with high-nitrogen fertilizer
on the farm of Gale and Clarence Chase,
Sun Prairie, Wisconsin
Ross Tuckwiller of Lewisburg, W. Va., found that
Greener, lusher pastures begin with NITROGEN
Spring application of 10-10-10 raised his pasture yield

• United States Steel advertisements are now featuring case histories on the advantages of high-nitrogen fertilizers. They tell of profitable yield increases and lusher, more productive pastures that have saved money in reduced feed costs. U.S. Steel ads running in February in the leading farm publications have a combined circulation of over 1,547,000.

Some ads have featured messages from noted agronomists urging the use of high-nitrogen fertilizers to help pastures overcome the damaging effects of last year's drought. They advised *earlier* application this year to promote earlier growth. This means earlier sales.

Be sure your dealers are ready for the increased demand by being adequately supplied with 8-8-8 and 10-10-10. And be sure that the major nitrogen source in your mixed fertilizers is U·S·S Ammonium Sulphate. Farmers will be looking for it more this year . . . they know it means "better nitrogen for better yields".

For better sales use U·S·S Ammonium Sulphate . . . and let the farmers *know* it. Take advantage of this promotion. Get full information on U·S·S Ammonium Sulphate from our nearest Coal Chemical sales office, or write directly to United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

U·S·S AMMONIUM SULPHATE

4-468

UNITED STATES STEEL

Versatile new insecticide

MALATHION*

creates new marketing opportunities

Years of testing by state and federal authorities and extensive grower experience have proved that malathion solves a large number of important insect control problems.

In field and orchard, malathion has proved extremely effective against aphids and mites as well as many other insect pests on a wide variety of fruit and vegetable crops.

In the garden, malathion controls aphids, mites, beetles, leafhoppers, scales and a host of other insect pests on flowers, shrubs, fruits and vegetables. In fact, malathion solves practically *every* garden insect problem.

In and around dairy barns and other places where flies gather or breed, malathion is an amazingly efficient fly-killer. It even kills flies resistant to DDT and other chlorinated insecticides.

This broad-range insecticide offers many advantages in use. *It combines high insect toxicity with low mammalian toxicity.* The USDA has called it "one of the safest insecticides to handle." It's easy to use, gives effective insect control with maximum safety to plants. It is compatible with most other spray materials, and residues on crops disappear quickly. For all these reasons, malathion has been called "the most promising new insecticide." A product of American Cyanamid research, malathion is opening up new profit opportunities in agricultural marketing.

Distributors and Dealers . . . Malathion insecticides in dust, wettable powder and emulsifiable liquid forms are available from well-known manufacturers, packaged under their own brand names. Consult your regular sources of supply, or write for further information.

**Also known as MALATHION*

AMERICAN Cyanamid COMPANY

Manufacturer of MALATHION Technical

AGRICULTURAL CHEMICALS DIVISION

30 Rockefeller Plaza, New York 20, N. Y.

Producers of:

AERO® Cyanamid: Fertilizers — Defoliants — Herbicides
AEROPRILLS® Fertilizer Grade Ammonium Nitrate
AERO® Ammonium Sulphate
PHOSPHATES for Acidulation and Direct Applications
THIOPHOS® Parathion Technical
CYANOGAS® Calcium Cyanide Fumigants
HCN Fumigants
ACRYLON® Spot Fumigant
POTASSIUM CYANATE Weedkiller for Agriculture and Turf
AEROTIL† Soil Conditioners

†Trade-mark

Editorial
COMMENTS

INTRODUCTION of a new bill (H.R. 7125) in Congress by Rep. A. L. Miller (R.Neb.), offers promise that, after a long period of waiting and delay, the farmer, the food packer, the public and the pesticide industry may finally be nearer to getting sensible new regulations on control of use of pesticidal chemicals on food crops, . . . which all seem to recognize and agree are needed. As Rep. Miller pointed out in a recent Congressional address dealing with the new bill, the primary need is for the establishment of safe, workable tolerances for essential pesticidal chemicals.

Lengthy public hearings were held way back in 1950, he reminds . . . at a cost of nearly half a million dollars to government, industry and agriculture. Yet almost four years later, these endless hours of testimony have yet to be translated into issuance of a single "tolerance" recommendation. His new bill "is designed to remedy this defect by providing a simple, more appropriate procedure to establish tolerances for pesticide chemicals and to prevent the use of the new pesticide chemical until such a tolerance as needed has been established."

A procedure for prompt and efficient issuance of such tolerance regulations is an obvious need, —and This Rep. Miller's new bill promises to assure. And, as he points out, this would be definitely to the advantage of all concerned. "The food consumer for the first time would be assured that a tolerance assuring safety has been established. . . . "Chemical manufacturers would have standards upon which to base recommendations to the grower" . . . . The grower would be assured that he would be in compliance with the law" . . . . and "The Department of Health, Education and Welfare would have a definite standard to carry on their enforcement responsibilities."

In view of the long past delays, and in the face of the urgent immediate need for such legislation, it would seem to us that now is the time for farm groups, food packers, pesticide manufacturers and the public at large to get behind this new measure and urge on their representatives in Congress its prompt enactment into law.

THE Tennessee Valley Authority has issued its annual report. TVA,—like any government agency—and many other enterprises too for that matter is not immune from the human tendency to attempt, in its report, to justify its existence and celebrate its accomplishments.

Figures are cited, for instance, to show that TVA made a profit on its sales of fertilizers and munitions. Somehow, even after reading the report, we are still a little skeptical on this point. We would want to feel sure first that the TVA bookkeepers had counted all the expenses that can't be dodged by private industry,—that they hadn't simply forgotten about such substantial items as interest on investment, depreciation, obsolescence, etc., in compiling their P and L statement. Furthermore in any fair analysis of

(*Turn to Page* 135)

President-elect (1955) of E. S. A. views the important role of

Insects in the Economic Future of Man

OF all the creatures on this earth, insects are man's greatest rivals, economically and otherwise. Each year in the United States alone they destroy crops, livestock, and farm produce equivalent to the entire agricultural output in the five New England states, plus New York, New Jersey, and Pennsylvania. Stated in another way, insects nullify the labor of at least a million working men each year. To make another comparison, the annual tax imposed by insects exceeds the annual appropriations for the support of the six great federal departments of Agriculture, Commerce, Interior, Treasury, Post Office, and Labor.

Since all speculation as to the future economics of insect damage and insect control should logically be based on a knowledge of past and present conditions, a somewhat detailed review of historic and current trends appears to be in order.

When man appeared on the scene, he found insects in full possession of this planet. They had made their appearance ages earlier and had developed to a point of dominance in the animal kingdom through the exacting processes of evolution. Highly diversified and perfectly attuned to conditions prevailing in their respective ecological habitats, insects were in a sense far better prepared for a battle of the survival of the fittest than man, who, poorly adapted as he is, must to a very great extent rely upon his far from infallible intellect not only to establish a defense against his enemies, but also in many cases to modify the environment in which he finds himself so as to make his very survival possible. Man, then, exists because of his ability to "outsmart" insects. Actually, he is a late arrival who has attempted to displace a well adjusted and highly versatile original population, which bars no holds to recover its lost property.

In the words of the scholarly, immortal S. A. Forbes: "The struggle between man and insects began long before the dawn of civilization, has continued without cessation to the present time, and will continue, no doubt, as long as the human race endures. We commonly think of ourselves as the lords and conquerors of nature, but insects had thoroughly mastered the world and taken full possession of it long before man began the attempt. They had, consequently, all the advantage of a possession of the field when the contest began, and they have disputed every step of our invasion of their original domain so persistently and so successfully that we can even yet scarcely flatter ourselves that we have gained any very important advantage over them. . . . If they want our crops they still help themselves to them. If they wish the blood of our domestic animals, they pump it out of the veins of our cattle and our horses at their leisure and under our very eyes. If they choose to take up their abode with us we can not wholly keep them out of the houses we live in. We can not even protect our very persons from their annoying and pestiferous attacks, and since the world began we have never yet exterminated—we probably never shall exterminate—so much as a single insect species."

Thirty years ago a paper entitled "The Role of Insects in the Economic Future of Man" would have been regarded as a gross underestimation of the potentialities of the class Insecta. About that time L. O. Howard was bringing forth his "Insects, Our Formidable Rivals," "Our Fight Against Insects," "The Insect Menace," "The War against Insects," and "Man and Insects," emphasizing in each case that man and insects were engaged in a war of the survival of the fittest and that there was grave doubt as to which might be victorious. In this campaign he had strong support from other outstanding entomologists and biologists and some popular writers, for example, C. T. Brues' "Is Ours the 'Age of Insects'," William Crowder's "Insects and Human Destiny," and E. O. Essig's "Man's Influence on Insects," the last paragraph of which typifies the thinking of the day: "Ours is not the menial chore so often alluded to as 'chasing bugs,' but the rather gigantic task of saving the human race!"

We must recall, however, that in the 1920's and '30's, despite remarkable progress in the field of medical entomology, insect-borne diseases were rampant in many parts of the world and there was the ever-present danger that recurring outbreaks of malaria, yellow fever, bubonic plague, typhus, and a multitude of lesser insect-borne diseases might

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so weaken the human race as to make its survival difficult.

In the agricultural field, as Forbes and others have stated, man has found insects competing with him for everything he desires, attempts to produce or possess. Sketchy but nevertheless authentic records of insect ravages to man's crops and animals date back to the dawn of civilization. Several references in the Bible attest to the ravages of locusts and a number of other insects, presumably Divinely imposed as a plague upon the offending children of Israel. Then, too, the Persians, Egyptians, Chinese, Greeks, and Romans were not unaware of the ravages of insects, and one cannot help but wonder what the authentic records of lost civilizations might reveal in the way of records, anecdotes, or even statistics on insect abundance and crop losses.

There are those who will claim, "Insects are getting worse each year," or "My father and grandfather were not bothered by insects," but history belies such testimony. Indian legends and sketchy records of the first settlers in America assure us that insects were abundant in this country before the appearance of white men. Dr. H. B. Weiss, in his "The Pioneer Century of American Entomology," draws attention to many interesting tales of insect activity in colonial days which attest to the fact that prior to the year 1800 farmers complained of insect pests just as they do today. Bartram, Peck, and Harris wrote rather extensively about many of the insect pests listed in the most recent entomological text books. Let us not overlook some of the important and in some cases tragic insect outbreaks in American history. Have we forgotten the Colorado potato beetle, the chinch bug, and Rocky Mt. locust?

By 1850 farmers, and orchardists in particular, became so distressed by insect plagues which they were unable to combat successfully that they began to demand the appointment of state and federal entomologists to study their problems and develop much needed insect control measures. Thus Townsend Glover was appointed as entomologist in the U. S. Patent Office in 1854, eight years before the federal department of agriculture was created. Also, in 1854 Dr. Asa Fitch was appointed State Entomologist of New York. Both of these appointments preceded by eight years the passage of the "Morrill Act" of 1862, which in effect authorized the creation of the "Land-Grant Colleges." In the Midwest where ravages of chinch bugs, grasshoppers, armyworms, potato beetles, and a host of other pests were creating havoc and causing many farmers to sacrifice or in some cases abandon their farms in favor of some less hazardous and more profitable occupation, Benjamin D. Walsh was appointed state entomologist of Illinois in 1867 and Charles V. Riley was appointed in the state of Missouri in 1868. These appointments were independent of but almost simultaneous with the creation of the "Land Grant Colleges" in these states, which in itself shows the importance and significance the farmers, agricultural leaders, and legislators attached to insects and insect control problems.

Perhaps it is a tribute to the entomological profession that in the short span of one hundred years the major insect pests (bad as the situation may seem today) have been brought under control to the extent that there is danger this historic concept of the proper relationship between entomology and other phases of agricultural research may be reversed. Now we find men in high places so blinded by their own success in the applied arts that they regard the fundamental sciences of mathematics, chemistry, and biology as mere tools which should be placed in their incompetent hands for guidance, supervision, and use. In some organizations this rape of a fundamental science (plant pathology) has transpired with disastrous results.

May we not profit by considering the history of medical entomology. With the advent of startling developments in this field, the medical profession, ever jealous of its assumed prerogatives and fearful that someone else might get due credit for work in the public health field, rushed in and assumed full command of the situation. All too often men who were highly skilled and fully competent physicians, but at the same time poorly trained in the fundamental sciences of chemistry, physio-

*Presented at meeting of the Entomological Society of America, December 7-9, Los Angeles.

Average (United States) per acre yields for five years before and after DDT came into general use in 1946.

TABLE 1

Field Crop	Criteria of yield	Yields 1941-1945	Yields 1947-1951	Per cent increase or decrease	Insecticide usage
Wheat	bushels	17.50	16.64	—4.96	scant
Flax	tons	1.81	1.77	—2.21	scant
Pasture	% normal	82.14	82.63	0.60	scant
Hay	tons	1.36	1.37	0.74	scant
Oats	bushels	32.20	34.14	6.02	scant
Cotton	lb.	262.40	280.08	6.74	extensive*
Corn	bushels	32.80	36.46	11.14	light
Peanuts	lb.	674.20	778.40	15.46	extensive
Sugar beets	sh. tons	12.40	14.48	16.77	extensive
Tobacco	lb.	1032.40	1240.20	20.13	extensive

*Crop also extensively treated prior to 1946.

TABLE 2

Truck Crop	Criteria of yield	Yields 1941-1945	Yields 1947-1951	Per cent increase or decrease	Insecticide usage
Pimientos	crates	1.17	1.13	—3.25	scant
Beets—mkt.	bushels	181.20	184.80	1.99	scant
Peppers	bushels	216.60	228.60	5.54	scant
Eggplant	bushels	231.00	245.80	6.41	scant
Cabbage—mkt.	tons	6.90	7.72	11.88	extensive*
Sweet corn	tons	2.39	2.74	14.81	extensive
Cauliflower	crates	291.60	348.00	19.34	extensive*
Onions	sacks	276.00	332.40	20.43	
Celery	crates	446.20	628.00	40.74	extensive*
Potatoes	bushels	141.50	228.88	61.75	extensive*

*Crops extensively treated prior to 1946.

logy, and biology, were placed in full charge of projects they were in no wise competent to direct. Progress was gradual but slow until the emergency situations that arose during World War II made the acceleration of research imperative. Then competent scientists, physiologists, parasitologists, entomologists, and chemists with mere Ph.D. degrees were elevated to positions of responsibility and given more or less free rein. What happened is now a matter of history. You may wonder what all this has to do with "The Role of Insects in the Economic Future of Man." The answer is—plenty! The future of insects is closely tied up with the future of entomology, and if the fundamental sciences, including entomology, are to be subjugated by the applied arts, then may Heaven help entomology. The insects will be fully capable of looking out for themselves. That is as it was in the beginning, is now, and ever shall be.

One can hardly develop the subject, "The Role of Insects in the Economic Future of Man." without dabbling in statistics. The writer recognizes his limitations in this field, and proceeds with more than a little reluctance and with due apologies to economists and statisticians. Perhaps if he could only understand and fully explain to you how it is possible to borrow yourselves out of debt, then he could proceed with greater confidence.

Annual Insect Damage Tremendous

WE have noted that insects ran rampant over the country from colonial days down to the close of the last century. Detailed observations and records of actual insect populations or crop damage were rarely made. Thus, while we have no actual figures on the extent or magnitude of crop and other losses attributable to insects, it seems quite apparent that farmers were share-cropping with or for the insects, and that the insects' share may have been in the neighborhood of fifty percent. You may recall that the entomologists of fifty years ago were regarded as a bit queer and were subjected to much ridicule by laymen and scientists alike. It was only natural, therefore, that they were rather hesitant to risk further ridicule or downright scorn by setting forth what to the laymen might be considered fantastic estimates of insect losses.

In 1891 James Fletcher, in his presidential address before the American Association of Economic Entomology, courageously made the astounding statement, "The amount of damage done to crops every year is so vast that the figures excite incredulity from those who do not study crop statistics. The agricultural products of the United States are estimated at about $3,800,000,000. Of this it is thought that about one-tenth is lost by the ravages of insects."

In more recent years, several entomologists have ventured estimates on insect losses, but for the most part, with only minor variations, most of them adhered to Fletcher's factor of 10% as the basis for making their estimates. Applying the same factor to annual production records each year might be interpreted as saying that economic entomology made no significant progress in over 60 years. To such a conclusion we do not and cannot subscribe. At least three quite unrelated factors combine to create this apparition, and they should not be overlooked:

(1) In the light of present knowledge, historic records would indicate that at the turn of the century insect losses were grossly underestimated; (2) many of our most destructive insect pests were introduced from foreign countries during this period; and (3) American market standards have been raised so that insect-damaged produce can no longer move freely in interstate commerce.

Several years back Dr. J. R. Parker (1942) reviewed past estimates of insect damage in some detail and he emphasized the need for surveys and critical research that would enable us to make reasonably accurate estimates of insect losses. Unfortunately, few if any of us can truthfully say that we answered his call to duty. As the writer labored on the preparation of this paper, the extent of our failure became quite clear, and he resolved to try and implement Dr. Parker's plea by presenting fragments of evidence, which

TABLE 3

Seed Crop	Criteria of yield	Yields 1941-1945	Yields 1947-1951	Per cent increase or decrease	Insecticide usage
Broomcorn	lb.	330.0	282.2	—14.48	scant
Timothy	lb.	154.6	139.2	— 9.96	scant
Alsike clover	lb.	119.4	132.2	10.72	moderate
Cowpeas	bushels	5.5	6.2	13.92	moderate
Red clover	lb.	47.2	55.6	17.80	moderate
Sweet clover	lb.	129.8	154.8	19.26	moderate
Alfalfa	lb.	73.0	103.8	42.19	moderate
Sugar beet	lb.	1844.8	3215.2	74.28	extensive

Average per acre yields before and after DDT came into general use in 1946.

though perhaps vague, controversial, and possibly unconvincing, might stimulate the thinking and imagination of others and thereby promote research on the evaluation of insect losses.

Insect Damage Not Fully Recognized

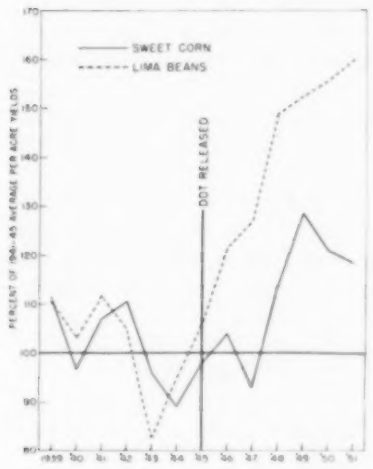
TO obtain a vague idea of the extent of unrecognized insect damage, one need only consider the extent and magnitude of insect populations. It has been stated that the total mass of protoplasm produced by insects each year exceeds that produced by all other terrestrial animal life put together. If we recall that much of this entomological protoplasm represents lost plant and animal production that might have been more profitably converted into products for human consumption, we can arrive at only one conclusion—insect losses are of enormous proportions.

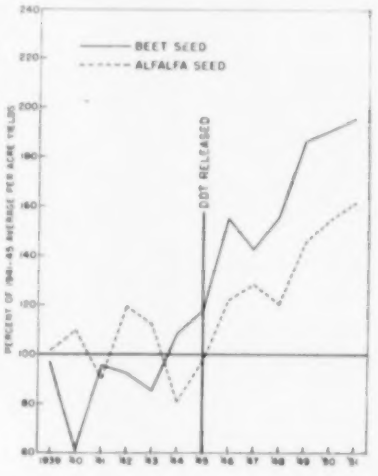
Not only do we fail to recognize and evaluate hidden or obscure losses, but all too often conspicuous crop losses are misidentified and attributed to drouth, excess rain, poor seed, or just plain hard luck, e.g. sod webworm larvae, well hidden in the turf mat and unobserved, frequently cut and consume practically all of the green foliage in parts of a lawn or pasture, thereby exposing dead brown leaves of the turf mat, and the owners scream "Drouth," even though there may be more than adequate moisture in the soil.

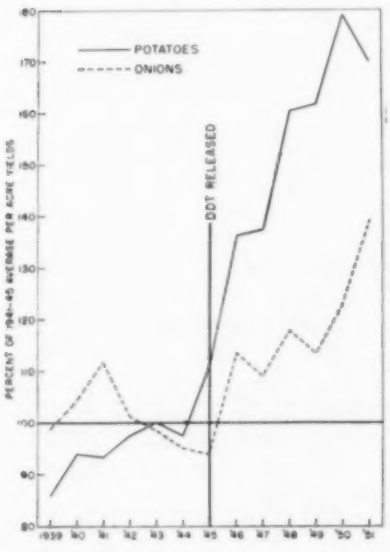
In 1935 insects one after another were especially serious on midwest corn from early spring to late summer and plants were materially weakened, but because the corn was especially tall by July 1, fields looked unusually good from the road. Entomologists and a good many farmers had a hearty laugh when midsummer corn yield estimates were released. The majority of farmers who watched their fields and know what happened and when, will agree that insects and insect-borne diseases did more to cut corn yields in central and northern Illinois than did the drouth. Nevertheless, dry weather did take over in time to justify face-saving reductions in corn yield estimates in September, October, and November, and history will attribute reduced corn yield to drouth, not insects.

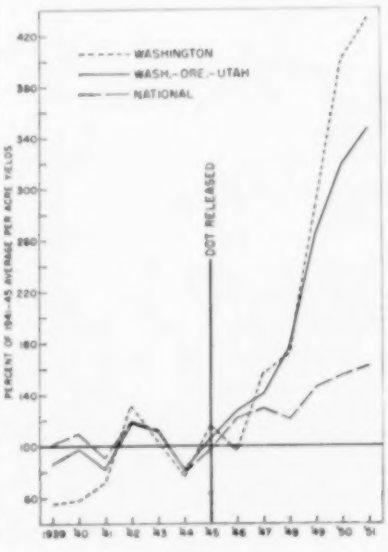
How often have we considered all of the many insect pests that attack practically every crop at some time during the season? Have we not been prone to consider only one or two species that attracted considerable attention, guess at the acreage involved, guess at the degree of damage, and then guess that perhaps 5, 10, or 15 per cent of the total crop had been damaged or lost? Have we forgotten that long ago some smart politician discovered he could

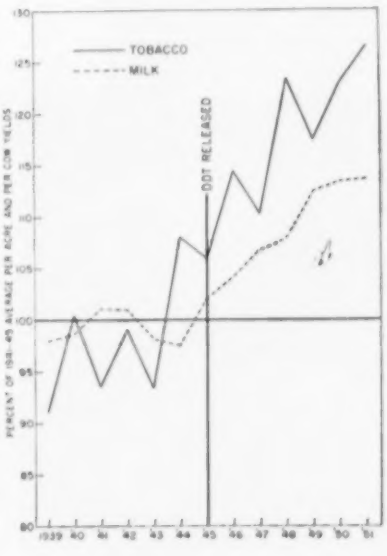
(*Turn to Page* 111)











Figures 1, 2, 3, 4 and 5

North Eastern

WEED CONFERENCE

DISCUSSIONS on specific uses of herbicides; results of field and laboratory tests with new weed killers; the outlook of future needs in the herbicide field; phytotoxicity; pre-emergence and emergence studies; and a series of general recommendations for herbicide applications were featured in several concurrent sessions at the eighth annual meeting of the Northeastern Weed Control Conference, held January 5-7 at the Hotel New Yorker, New York City. Besides the strong technical sessions, at which more than 100 papers were presented, the membership held an election of officers at which A. O. Kuhn, Univ. Maryland, College Park was elected president, succeeding R. H. Beatty, American Chemical Paint Co., Ambler, Pa.; J. D. Van Geluwe, Grange League Federation, Ithaca was elected vice president; and W. C. Jacob, Cornell Univ., Ithaca, re-elected secretary-treasurer. R. D. Sweet of Cornell Univ., Ithaca, was elected as the Northeastern Conference member to the editorial board. Still another highlight of the three-day session was the presentation of several awards.

L. I. Jones, USDA Extension Service, Washington, D. C., presented the award for outstanding service to the industry to N. J. Smith, assistant county agricultural agent, Madison County, N. Y. A series of five awards for the most valuable and interesting papers submitted to the association for 1953 were presented to the following: J. W. Brown, Camp Detrick, Frederick, Md., for the report "Studies on Entry of 2,4-D into Leaves." (Co-authors: R. L. Weintraub, J. N. Yeatman, J. A. Thorne, and J. R. Conover); S. L. Dallyn, L. I. Vegetable Research Farm, Riverhead, N. Y., for his report on "The Effect of Soil Organic Matter Levels on Several Herbicides;" L. L. Danielson, Virginia Truck Exp. Station, Norfolk, for his report on "Experimental Use of Herbicides Impregnated on Clay Granules for Control of Weeds in Certain Vegetable Crops;" W. E. Chappell, Virginia Agricultural Exp. Station, Blacksburg, for the paper, "Cultural vs Chemical Weed Control in Soybeans;" and A. H. Fletcher, who received the award for John H. Ruskin on the latter's report "Public Health Significance of Ragweed Control Demonstrated in Detroit."

In discussing "Future Needs in the Chemical Herbicide Field", E. P. Sylwester, Iowa State College, Ames, Io. reported that in addition to a "team of chemicals to handle a variety of weeds and brush (such as sodium chlorate, "Ammate," the dinitros, CMU, pentachlorophenol, 2,4-D, 2,4,5-T, TCA, "Atlacide," borax compounds, herbicidal oils, etc), the industry also needs a good array of "specifics." He indicated that in particular, effective chemicals for specific control of milkweed, devil's shoestring, horse nettle, dogbone, and grassy weeds, are needed. Mr. Sylwester stressed the need for an educational and enforcement program in weed control.

J. W. Mitchell, Plant Industry

L. I. Jones (right), USDA Extension Service, Wash., D. C. presents award for service to the industry to Norman J. Smith, assistant county agricultural agent, Madison County, N. Y.

HELD

Seated, left to right, newly elected officers for 1954: W. C. Jacob, secretary-treasurer; A. O. Kuhn, president; and J. D. Van Geluwe, vice-president.

Standing, left to right, committee chairmen for 1954: Program, W. W. Smith, Coordinating, L. L. Danielson, Membership, C. Hovey, and Publications, R. J. Aldrich.

Station, Beltsville, Md., in his report on absorption and translocation studies, described the new plant growth modifying chemical MOPA (alpha methoxyphenylacetic acid), which when placed on leaves is absorbed, moves down the stem into the roots, then out of the roots into the soil. He continued to say that the chemical is then readily absorbed by roots of nearby plants and translocated to their leaves where it checks growth. Studies are now under way to determine if practical application can be made in field control of plant growth or crop pests.

Studies on the effect of soil organic matter levels on several herbicides, reviewed by S. Dallyn, Long Island Vegetable Research Farm, Riverhead, N. Y., were reported to show a marked relationship between CMU and soil organic matter (using red beets and sweet corn as the test crop). The lower the organic content, the more subject the crop plants were to injury from the herbicide. Similar results were found with "Crag," but not with "Sesin," or 2,4-D, under the conditions of the experiment.

A careful investigation of the compatibility of weed killing chemicals and insect killing chemicals was recommended by Drs. L. L. Danielson and R. N. Hofmaster, Virginia Truck Experiment Station, Norfolk, since several tests combining two chemical weedkillers and two insecticides (singly and in combinations) were found to reduce yields severely on sweet corn when used in combination; yet the materials were only mildly toxic to the corn when used singly. Synergistic action was suggested as a possible explanation.

Dr. Danielson also reviewed the experimental use of dry applications of herbicides inpregnated on clay granules, on several vegetable crops. He indicated that granular applications of such chemicals might be feasible on some crops which will not tolerate spray applications, and in this way extend their use.

Studies of the use of wetting agents, surfactants, etc. with herbicides were reported to increase phytotoxicity, according to C. R. Skogley, Rutgers Univ., New Brunswick, N. J. With certain of the contact herbicides, as much as 75 to 100 per cent increase in effectiveness was noted by the addition of two pounds of wetting agent per acre.

A. J. Tafuro, R. H. Beatty and C. C. Jack, American Chemical Paint Co., Ambler, Pa., submitted a report on the effect of six herbicides on alfalfa and clovers underseeded to spring oats. Test data indicated that of the compounds tested, 3,4-dichlorophenoxyacetic acid was most selective on legumes and gave less injury than 2,4-D, MCP, and 4-chlorophenoxyacetic acid. The 4-chloro product gave the most injury to the legumes and delayed maturity of grain for as much as two weeks.

Preliminary studies with new herbicides applied to asparagus plantings were reported by E. R. Marshall and N. A. Ferrant, G.L.F. Soil Building Service, Ithaca, N. Y. Included in the tests were "Natrin," "Sesin," "Crag" herbicide, PDV, "Sinox PE," LV4, 3,4-dichlorophenoxy ethyl sulfate, and 2-methyl, 4-chlorophenoxy ethyl sulfate.

"Natrin" gave good control of weeds and excellent grass control. It was found to be rather selective on the weed species controlled. "Sesin" showed longer residual control than either "Crag" herbicide or "Natrin;" PDU was very similar to CMU, but had a somewhat shorter residual effect.

CMU, PDU, and 2-methyl, 4-chlorophenoxy-ethyl sulfate gave the longest residual weed control of the materials tested. The only treatments which injured the asparagus were "Sinox PE" and LV4.

Chemical weed control in asparagus, using CMU and other herbicides was discussed in several reports by A. H. Kates, Seabrook Farming Corp., Bridgeton, N. J.; R. F. Carlson and F. H. Grigsby, Michigan State College, East Lansing; and E. M. Rahn, Univ. of Delaware, Newark, Del. The use of "Alanap" on horticultural crops was reviewed in reports by W. H. Lachman, Univ. of Massachusetts, Amherst, and S. L. Dallyn, L. I. Vegetable Research Farm, Riverhead, N. Y.

Robert D. Sweet, Cornell Univ., Ithaca, in reporting on the effect of environmental factors on sweet corn response to herbicides indicated that the dinitro materials, particularly the alakanolamine salts of DNOSBP were excellent for con-

(*Continued on Page 131*)

INSECTICIDE FERTILIZER COMBINATIONS

By F. B. Folckemer* and E. S. Loeffler*

Julius Hyman & Co.
Subsidiary of Shell Chemical Corp.
Denver, Colo.

THE practice of using insecticides mixed with fertilizers is relatively new, and is generating considerable interest in both the insecticide and fertilizer industries. The introduction of such mixtures has been a natural consequence of the discovery that some of the newer insecticides are economically effective for the control of insects which spend a susceptible phase of their life cycle in the soil. A grower demand for the mixtures has become evident because application of fertilizer and insecticide can be made at the same time with the same equipment, with definite advantages in the way of savings in time and labor.

A number of the chlorinated organic insecticides which have been so spectacular in general insect control are also effective for control of insects in the soil. DDT, which was the first of these insecticides to be developed, was found to give control of wireworms and certain other soil pests, and benzene hexachloride was later found to give even better control of these insects. However, benzene hexachloride is phytotoxic under certain conditions, and may cause off-flavor in certain food crops. Lindane, which is the purified gamma isomer of benzene hexachloride, gives the same degree of control and is much safer with respect to crop damage. Some of the newer insecticides, such as toxaphene, chlordane, aldrin, and dieldrin have proved to be more effective than benzene hexachloride or DDT against many species of soil insects. Of this group, chlordane and aldrin have been most widely used. Aldrin has been gaining wide acceptance, because of its general effectiveness, lack of toxicity to growing plants, freedom from off-flavor effects, and low cost of treatment. According to Tiedjens and Greenwood (9), aldrin and dieldrin are expected to enjoy the major use for soil pest control in the future. A still newer chemical, heptachlor, has also been demonstrated to be effective against soil insects, and may play a major role within the next few years.

Considerable experimental work has been done to demonstrate the practicability of using these soil insecticides in mixtures with fertilizers. The experimental mixtures were usually prepared by adding the insecticide by various means to regular commercial grades of mixed fertilizers. In 1949 Compton[1] reported that chlordane fertilizer mixtures controlled white grubs, mole crickets, and wireworms on potatoes. Woodle and Nettles (10) in 1950 reviewed the early work in which chlordane DDT, and benzene hexachloride mixed with fertilizers gave control of sand wireworm and southern corn rootworm on corn. Spectacular control of corn rootworm by the application of fertilizers containing aldrin, dieldrin, chlordane, heptachlor, or lindane was reported by Lilly and Gunderson (5,6) and Cox and Lilly (2) in 1952 and 1953.

Although much of the recent work remains unpublished, it has resulted in acceptance by federal and state regulatory bodies for the marketing of insecticide-fertilizer mixtures for use on several crops, including corn, sugar beets, and peanuts. Mehring (7) has stated that lawn fertilizers containing insecticides have been on the market for several years, and that farm fertilizers containing insecticides of various kinds were prepared on a custom basis on a small scale as early as 1949. Since that time many fertilizer companies have been marketing prepared mixtures of insecticides and fertilizers, and the market is expanding rapidly. Thousands of tons of such mixtures were sold in 1953, and it is predicted that the growing demand will result in a greatly increased production in 1954.

Incorporating insecticides with commercial fertilizers presents certain practical problems. The manufacture, storage and application of fertilizers are so well established that the pesticide, being the newcomer, must adapt

*Before American Chemical Society, Chicago, September, 1953.

itself to this established pattern. If the insecticide can be added to the fertilizer in one of the normal steps in preparation of fertilizer, a real economic advantage will be shown for the combined product. After incorporation into the fertilizer, the pesticide must remain an integral member of the partnership, must not adversely affect storage, use, application or effectiveness of the fertilizer, and must retain its insecticidal effectness.

Wide variations exist in the types and manufacturing procedures of the many fertilizers used, and it is beyond the scope of this paper to discuss all possible insecticide-fertilizer combinations. However, one of the greatest potentials for insecticide combinations is with the widely used inorganic type fertilizers. They are usually prepared by the ammoniation process, in which the nitrogen is added to the other ingredients in the mixer in the form of a strong ammoniacal solution, which reacts with the acidic phosphates, giving rise to appreciable heat and evolution of steam. Addition of insecticides during this blending and ammoniation process has been suggested. However, it is probable that the alkali-unstable insecticides such as DDT, benzene hexachloride, toxaphene, chlordane, and heptachlor would be decomposed by the strong ammoniating solution. Even aldrin, which is stable to alkali, has been found to suffer a loss when applied experimentally during the ammoniation process, probably due to volatilization because of the excessive heat in the mixer. The addition of insecticides to fertilizers during the ammoniation process does not appear to be practical.

A more satisfactory place for the addition of insecticides is during the blending and grinding operation after the fertilizer has cured, and just prior to bagging. Addition of pesticides to the mixer during this operation has proved very satisfactory if adequate blending and proper formulations have been used. In most fertilizer plants there is considerable dust present during the blending and bagging operations. This dustiness is of minor consequence in fertilizer production, but could be a problem when insecticides are added, due to discomfort, skin irritation or possible health hazards to the operator. However, this problem can be minimized by adding the insecticide in a form which is not dusty.

Impregnation Method

ADDITION of the toxicant in liquid form by spraying or dripping onto the fertilizer in the mixer will reduce the dust hazard. Studies with a commercial grade of aldrin (60% Aldrin solution), show that spraying the insecticide onto either a finely divided or granular fertilizer produces a product in which the insecticide is uniformly distributed. Analyses show that no loss of aldrin occurs in this process, and dustiness is minimized. The non-aqueous liquid toxicant is readily absorbed by the fertilizer and does not adversely affect the free flowing characteristics of the fertilizer after several months storage at elevated temperatures and under compaction pressures.

The impregnation method, however, is subject to limitations. The average fertilizer plant is not equipped for the spraying of liquids, and consequently the installation of additional equipment would be required. Also the impregnation process may require a longer mixing period than does the simple mixing of dry ingredients, which would mean that less product could be processed per day using this procedure.

The common method of adding the toxicant to the cured fertilizer in the mixer is as a solid, usually in the form of a concentrated powder or granular concentrate. Initially, the dust hazard of this procedure was objectionable, but this has been reduced through the use of improved dust formulations, and products with reduced dustiness are now available commercially. Dustless powders of many of the soil toxicants have been developed; as an example, a 20% aldrin powder free of dustiness or smokiness was prepared by adding 5 to 10% of kerosene or light oil to a 60% aldrin solution before it was impregnated on the carrier, which in this case was the highly absorptive "Attaclay."† This powder was free flowing, and reduced the irritation from dust below that normally obtained with fertilizers. Dustless powders are also prepared by the use of other dust-suppressing additives, or by the choice of less absorptive carriers which produce a slightly moist powder upon impregnation.

Dust-free granular insecticides that are made by impregnating the toxicant onto a granular type carrier are commercially available, and this form of insecticide has become popular for addition to fertilizers. The granules do not give rise to irritating dusts, and are particularly suited for addition to coarse or pelletized fertilizer, since they do not appear to stratify or separate from the fertilizer during storage or transit.

Adding Solid Insecticides

THE addition of solid-type insecticides can best be accomplished by direct addition to the mixer to avoid losses and hold-ups that have occurred when the insecticide was added into the conveyer system. The small amount of toxicant used must be evenly distributed throughout the fertilizer to achieve maximum insect control. For best mixing it is suggested that about 25% of the fertilizer be premixed with the insecticide for a few minutes before adding the balance of the fertilizer. This step-wise blending procedure is standard practice with many insecticide formulators when making field strength dusts from dust base concentrates. However, further investigation may show that satisfactory toxicant distribution can be obtained by increasing the blending time without the necessity for step-wise blending.

The foregoing discussion of methods of preparing insecticide-fertilizer combinations referred to inorganic fertilizers made by the ammoniation process; however, the general conclusions also apply to in-

† Product of Attapulgus Minerals & Chemicals Corp., Phila.

organic custom-mixed fertilizers and to organic fertilizers. Experimental studies have shown, for example, that aldrin can be added satisfactorily in liquid or powder form to organic fertilizers such as "Milorganite"** or "Vigoro."†† Most toxicants can be applied successfully to organic fertilizer by the same procedures that have proved satisfactory for the inorganics.

The prevention of caking and packing of fertilizers during storage and transit has long been a problem to fertilizer manufacturers, and specific additives have been developed for preventing caking. Addition of pesticides must not adversely affect free flowing tendencies or their use will meet with opposition. Experiments by the writers have shown that the incorporation of dustless aldrin powders or aldrin granular concentrates does not adversely affect flow characteristics of a fertilizer after several months storage. In several fertilizers that tended to cake in storage, the addition of solid aldrin formulations significantly decreased packing and caking tendencies.

Potential Toxicity Hazards

IT is recognized that the use of insecticides could introduce potential toxicity hazards that were not previously present in the fertilizer industry. However, experience of the pesticide industry shows that with proper precautions, these insecticides can be handled safely and easily. The very low concentrations of pesticide required in fertilizers do not constitute a hazard, and the concentrated forms of the toxicants can be handled without difficulty if the safe handling practices of the insecticide industry are observed. The degree of caution which must be exercised depends entirely upon the extent of exposure of the workers, and personnel who are directly exposed to highly concentrated poisons should be protected through the use of respirators, forced ventilation, protective clothing, showers, and protection against accidental ingestion of poison. Mixing equipment used for preparing insecticide-fertilizer combinations should not be used for mixing feeds or foodstuffs unless thoroughly washed with suitable solvents.

Insecticide-fertilizer mixtures are subject to regulatory laws governing the sale of insecticides, and must be properly labelled to show the weight percentage of insecticides they contain. They are subject to sampling and analysis by regulatory officials, and it is therefore necessary that proved analytical methods be available. Reliable methods are also required for quality control purposes. Standard methods of analysis are available for the various insecticides in the form of dusts, wettable powders, and liquid solutions, and these same methods can usually be adapted with some modifications to fertilizer mixtures. Sampling of the mixtures for analysis must be done very carefully, because of the heterogeneous nature of fertilizers.

Constituents Must Be Compatible

FOR any given insecticide-fertilizer mixture to be of value, it is essential that the insecticide be compatible with the fertilizer. This means, first of all, that there must be no chemical action between the various components, resulting in deactivation of the toxicant. This is a matter of prime importance to the fertilizer manufacturer, as he cannot afford to prepare mixtures which will decompose in storage. The chlorinated insecticides are known to be decomposed by contact with certain materials under adverse conditions. All of the insecticides mentioned previously, except aldrin and dieldrin, are known to be deactivated by alkaline materials, and should not be used with strongly alkaline fertilizers. Fertilizers which contain sufficient lime or free ammonia to make them basic may cause decomposition of these susceptible toxicants. Acidic components of mixed fertilizers, such as sulfuric and phosphoric acids and their acidic salts, would not normally affect the insecticides at the low concentrations encountered. However, it is possible that they could cause some degradation during prolonged storage, particularly if the products were stored at elevated temperatures.

Specific data on the chemical stability of many insecticides when mixed with fertilizers are not yet available in the literature. Fleck and Haller(2) demonstrated that DDT is not decomposed when heated with a variety of mixed fertilizers and fertilizer components, including ammonia sulfate, ammonium nitrate, monoammonium phosphate, ammoniated superphosphate, dicalcium phosphate, double superphosphate, potassium sulfate, potassium chloride, steamed bonemeal, Milorganite, and others. The only fertilizer tested which caused catalytic decomposition of DDT was dolomitic limestone. The chlorinated insecticides in general, when combined with fertilizers, have shown no tendency to break down in storage, according to Compton(1), Hayslip(4), and Tiedjens and Greenwood(5).

Further laboratory studies on storage stability are needed. These should include a series of practical tests, consisting of the preparation of insecticide-fertilizer mixtures of a wide variety of types, and the determination of storage stability under extreme conditions of temperature and humidity. Studies of this nature are in progress with fertilizers containing aldrin and deildrin. The results of these experiments, and of experiments involving the use of other insecticides, will do much to remove any uncertainties regarding storage stability of such products.

A second aspect of compatibility is the effect of combinations of insecticides and fertilizers on the germination of seeds and growth of plants. It is highly important that the use of the mixtures shall not result in any unfavorable alteration of growth response. The available data indicate that these insecticides which are safe to plants when used alone in the soil are also safe when used with fertilizers, and may even have a stimulating action. Stone and Smith(3) found that fertilizers containing aldrin, dieldrin, or chlordane stimulated the growth of corn significantly more than fertilizer

(*Turn to Page* 123)

**Product of Milwaukee Sewerage Commission.
††Product of Swift & Co.

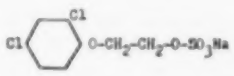
Herbicide Development

By A. J. Vlitos*
Boyce Thompson Institute, Yonkers, N. Y.

A discussion of the herbicidal action of aryloxy compounds, with observations on some of the hypotheses that have advanced to explain plant growth regulation.**

THE study of synthetic plant growth-regulating substances can be traced back to 1934 when Kögl, Haagen-Smit, and Erxleben (7) found that indole-3-acetic acid was capable of promoting cell elongation. An intensive study of indole compounds by Kögl and Kostermens (8) and by Hitchcock (3) followed this initial discovery. In 1935, Zimmerman and Wilcoxon (18) found that l-naphthaleneacetic acid and other arylacetic acids were active plant growth regulators. Later Irvine (4) showed that 2-naphthoxyacetic acid was also an active growth substance. Probably the most important single stimulus to the herbicide field came in 1942 when Zimmerman and Hitchcock (17) reported the plant growth regulatory action of 2,4-dichlorophenoxyacetic acid.

Since 1942 the use of 2,4-D in the United States has grown to a current annual rate of 28 million pounds. This substantial market for weed killers has intensified the interest and efforts of the chemical industry in its search for new and more effective herbicides. Thousands of the known chemicals have been tested and many more are being synthesized for this specific purpose. Thus far, the most rapid gains in uncovering new, active molecules have come from an empirical approach. An excellent illustration is the case of sodium 2-(2,4-dichlorophenoxy) ethyl sulfate, the structure of which is shown below.



This compound is one of many esters that can be formed by the reaction of 2-(2,4-dichlorophenoxy) ethanol with organic or mineral acids. When this chemical was submitted to the biological research team at Boyce Thompson Institute, Yonkers, N. Y., it was placed through the preliminary screening tests. When it was sprayed on the foliage of plants it was found to lack growth-regulating activity. When it was applied to seeds in Petri dishes it was also inactive, but when it was applied to seeds planted in soil, the seeds germinated but were rapidly killed. The chemical was also herbicidal if the seeds were placed in Petri dishes, treated with the chemical, and a handful of soil sprinkled over them. Dr. L. J. King, who was doing the initial evaluations, immediately saw a unique possibility. Here was a chemical that was without contact action or herbicidal activity when sprayed on foliage of plants, but it would destroy weed seeds as they were germinating. This chemical would eliminate the hazards of drift damage encountered so frequently with 2,4-D. Since 1949, sodium 2-(2,4-dichlorophenoxy) ethyl sulfate (called "Crag" Herbicide 1, 2,4-DS, and SES) has been established as a particularly effective weed seed killer in asparagus and strawberry plantings and has shown considerable promise in nurseries. It has offered many of the advantages of 2,4-D without the attendant hazards.

After sodium 2-(2,4-dichlorophenoxy)ethyl sulfate had become fairly well established as a herbicide, it was extremely desirable to backtrack to the early laboratory experiments and examine the reasons behind its unusual properties. King, Lambrech, and Finn (5) had found that if soil were autoclaved and then treated with sodium 2-(2,4-dichlorophenoxy)ethyl sulfate, the compound had no activity. They proposed that soil microbes were in some way responsible in converting the chemicals to active ingredients. Later it was stressed by Carroll (2) that when sodium 2-(2,4-dichlorophenoxy)ethyl sulfate was hydrolyzed in a test tube

*This research was done under the terms of a fellowship sponsored by the Carbide and Carbon Chemicals Co. The author is indebted to the chemists of the company for assistance in developing analytical methods.

**Known as CRAG Herbicide 1; 2,4-DS; and SES. This paper is a revision of a talk presented before the Research Committee Meeting of the Western Weed Control Conference on March 23, 1953, at Boise, Idaho.

with acids, 2-(2,4-dichlorophenoxy) ethanol and sodium acid sulfate were formed. Soil studies were begun and it was found that the chemical was indeed activated in acid soils, but activation also occurred in soils having neutral to alkaline reactions (14). Acid hydrolysis was not the only factor responsible for the conversion to an active molecule. The evidence pointed to a microbial factor, supporting the hypothesis advanced by King, Lambrech, and Finn (5).

Studies Pose Further Inquiry

TWO questions which arise in a study of this type are (a) what is the active compound (or compounds) formed when sodium 2-(2,4-dichlorophenoxy)ethyl sulfate is added to soil, and (b) what microorganisms are involved and how do they accomplish the conversion?

The first question was investigated by incubating the chemical in soil for varying lengths of time, extracting the soil with chloroform, and determining the amount of 2-(2,4-dichlorophenoxy)ethanol formed. A quantitative method for this compound based upon the color reaction of sodium 2-(2,4-dichlorophenoxy) ethyl sulfate with methylene blue was developed by chemists of the Carbide and Carbon Chemicals Co., New York, and will be published elsewhere shortly. It was found that a remarkably rapid formation of 2-(2,4-dichlorophenoxy)ethanol took place, but in no case was there complete hydrolysis of sodium 2-(2,4-dichlorophenoxy)ethyl sulfate. It was also found that 2,4-D could be detected by Freed's qualitative color reaction in soils treated with either sodium 2-(2,4-dichlorophenoxy)ethyl sulfate or 2-(2,4-dichlorophenoxy) ethanol. Thus, two compounds, both active in suppressing weed seed germination, are formed when sodium 2-(2,4-dichlorophenoxy)-ethyl sulfate is added to soil (14).

The second question posed by this intriguing problem was concerned with the identification of the soil microbes and their metabolic mechanisms involved in the conversion. The problem was attacked by storing soils treated with sodium 2-(2,4-dichlorophenoxy)ethyl sulfate for several days at room temperature, isolating the bacteria, fungi, and actinemycetes which appeared on soil dilution plates, and re-inoculating the individual isolate into sterile soils containing sodium 2-(2,4-dichlorophenoxy) ethyl sulfate. Seeds were placed in contact with the soil-herbicide-bacterial mixtures and root suppression was used as the indicator of activation. The 35th bacterial isolate so tested gave a positive test for activation. Subsequently there were some fungi isolated which also converted the compound to its active form, but the predominant organism isolated from these experiments and which exhibited a high rate of conversion was the soil bacterium *Bacillus cereus* var. *mycoides* (Flügge) Smith, Gordon, and Clark. Therefore, this organism was chosen as the one with which to study the mechanism and pathways of the conversion process.

When sodium 2-(2,4-dichlorophenoxy)ethyl sulfate was added to broth cultures of *B. cereus* var. *Mycoides* at pH values above 7.0, 2-(2,4-dichlorophenoxy)ethanol was formed rapidly. Evidently the hydrolysis is catalyzed by an exoenzyme since bacteria-free filtrates, which are heat-labile, can also convert sodium 2-(2,4-dichlorophenoxy)ethyl sulfate to the ethanol. 2,4-D was not detected in any of the cultures, which indicates that *B. cereus* var. *mycoides* cannot participate in the oxidation of 2-(2,4-dichlorophenoxy)ethanol to 2,4-D. Organisms responsible for the oxidation of 2-(2,4-dichlorophenoxy) ethanol to 2,4-D in soil are not known at present.

B. cereus var. *mycoides* does not hydrolyze 2-(2,4-dichlorophenoxy)ethyl benzoate (Sesin) or other related esters, which is indicative of a degree of specificity for the sulfate portion of the molecule. It seems likely that a sulfatase, in this case an exoenzyme, is produced by *B. cereus* var. *mycoides*, and that this enzyme can catalyze a hydrolysis which converts an inactive chemical to a plant growth regulator.

What factors in the plant cell determine whether sodium 2-(2,4-dichlorophenoxy)ethanol shall act as the toxic molecule? Altough several theories have been developed on the minimum structural requirements for growth-regulating activity of aryloxy compounds, none has been above criticism. One point has become apparent: There are so many types of growth phenomena that can be altered, and so many biochemical processes that can be blocked, that any attractive hypothesis has to be revised and brought up to date as new facts become available. The formulators of theories of growth-regulating action must beware that their hypotheses do not become obsolete too soon after they are formulated. The rapidity with which new compounds are being evaluated for their growth-regulating and herbicidal properties leaves little room for theories that are based on three, five, or even twenty compounds.

Structure Requirements in Plant Growth

ALTHOUGH the most rapid gains in uncovering new, active molecules have come from an empirical approach, there have been several attempts to generalize the structural requirements for plant growth-regulating activity. One of the earliest theories relating molecular structure to activity was put forth by Koepfli, Thimann, and Went in 1938 (6). They pointed out that at the time the only compounds that exhibited activity in the split-pea test possessed three essential characteristics: (a) they all had a ring system, with at least one double bond; (b) they all possessed a side chain with a terminal carboxyl group removed from the ring by at least one carbon; and (c) they all possessed a particular steric relationship between the ring and side chain.

These requirements for activity were based mainly on the split-pea test and a limited number of compounds. Nevertheless the theory was an important landmark in an attempt to explain growth-regulating action. The three requirements outlined above are extremely generalized and at the same time are restricted to compounds which exhibit activity in one test,

namely the split-pea test. As new knowledge has become available and as other biological tests have been developed, it is now necessary to examine the requirements for growth-regulating activity more critically.

Veldstra (13), for example, has offered an interpretation of activity as measured in polarographic studies. For a compound to be a growth regulator it should possess, according to Veldstra, (a) a ring system with a high-surface activity, and (b) a carboxyl group (or its dipole) in a definite spatial position with regard to the ring. Thus, according to this interpretation, growth substances exert their physiological effect at the protoplasmic membrane, where after adsorption and surface boundary orientation there is an effect on the permeability of cell membranes and later on transport of metabolites. Increased growth is therefore due to an increased flow of essential metabolites. Although this theory is extremely attractive, we are still in need of adequate studies of the nature and properties of the protoplasmic membrane, and the mechanisms by which its functions are disrupted by plant growth regulators. It is also necessary to define "surface boundary orientation" in terms of the types of chemical bonds and the specific requirements of a compound to exert these effects.

Enzymes in Growth Activity

MANY investigators have expressed the view that growth-substance activity is essentially due to an action on enzyme systems or that growth regulators act as co-enzymes in key reactions. Only one of these theories will be discussed in detail. Muir, Hansch, and Gallup (9) and Bonner and Bandurski (1) have been its chief proponents. This is the so-called "two-point attachment" hypothesis or a variation of the theory of competitive inhibition of animal biochemistry. It is known that the molecules which are active in the *Avena* coleoptile test possess two characteristics; namely, a carboxyl group and a free ortho position. What is the role of each of these? Since plant growth regulators are active in extremely low dosages, there is indication that they may act as co-enzymes, or that they are bound to plant proteins as prosthetic groups. There is some evidence that in spinach leaves naturally-occurring auxins (compounds active in the *Avena* test) are bound to a protein fraction and that upon alkaline or enzymatic hydrolysis the auxin is released. 3-Indoleacetic acid also exists only in a bound form in the tissues of many green plants (15). It has been postulated that the carboxyl group of the auxin is involved in the binding, possibly through peptide bond formation. Thimann and Bonner (11, 12) suggest that the presence of -SH groups in the plant cell accounts for the activity of auxins. If -SH groups are immobilized with suitable reagents, plant cells will not react to many auxins. The role of the free ortho position in the active molecule is postulated to depend upon the reaction with -SH groups and in this way to interfere with essential biochemical pathways. The basic concept of two-point attachment then is that an auxin must have two functional positions that can enter into reaction with two suitable receptors within the plant cell. Recently a three-point attachment concept has been discussed (16) based on the work of Smith and Wain (10). In addition to a free ortho position and a carboxyl group, the possession of an alpha-hydrogen atom would appear to be requisite for activity.

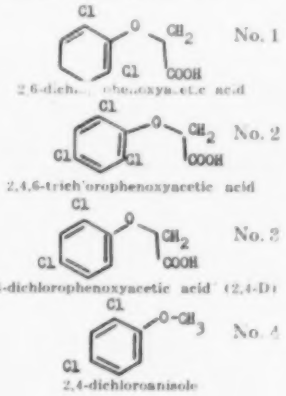
In recent years some stress has been laid upon the role of antiauxins in cellular physiology. Antiauxins can be defined in general terms as compounds which can offset the activity of known auxins in the *Avena* coleoptile test. These compounds can be employed as tools with which to further our knowledge of plant growth regulators.

Compounds 1, 2, and 4 are all effective in inhibiting the action of 2,4-D in the *Avena* test. The formula of 2,4-dichloroanisole resembles that of 2,4-D in every respect except for the absence of a carboxyl group. In 2,4,6-trichlorophenoxyacetic acid and 2,6-dichlorophenoxyacetic acid the necessary ortho position is blocked. In all three compounds, however, there is the possibility for attachment with a cell receptor at one point, but none can attach at two points. This can then be looked upon as a variation of a competitive inhibition phenomenon. The experimental evidence presented in favor of this hypothesis has come from studies made almost exclusively with the *Avena* coleoptile. Although there is abundant evidence from comparative biochemistry that biochemical pathways of metabolism are basically similar in living materials, there are nevertheless many examples of divergent mechanisms and pathways of metabolism in closely related plants and even in the same plant species of different age. Therefore, unless the categorical term "plant growth regulator" is to be rendered meaningless, it is essential that the ontogenetic and phylogenetic scope of the test object be extended to include cells and tissues of plants other than the *Avena* coleoptile or etiolated pea.

It is the author's opinion that the hypotheses advanced for growth-regulating activity thus far have been based either upon a limited number of chemicals or upon restricted biological test objects. Although the frontiers of our knowledge in this field have been greatly extended by the use of simple biological tools, none of the theories that has been presented to explain growth-regulating activity can be unequivocally accepted in its entirety. Until our knowledge of cellular physiology has progressed to a

(*Continued on Page* 117)

The chemical structures of four compounds appear below:



Research on the

MANUFACTURE OF FERTILIZER

RESEARCH in use of fertilizers is being carried out at a large number of colleges and universities throughout the United States. However, little research and development in fertilizer manufacturing processes is being done in these institutions. One of the very few colleges at which a substantial program in fertilizer manufacturing research and development is under way is Iowa State College at Ames, Iowa.

A program in this field was begun in the Chemical Engineering Section of the Engineering Experiment Station at Iowa State College about six years ago. It was felt that many worthwhile projects could be carried out which were not being investigated by the various laboratories of the federal government and the fertilizer industry. The use of chemical fertilizers in Iowa has increased enormously in the past few years; before the war only a few thousand tons of fertilizer per year were used, but in 1952 over 400,000 tons were used. Similar large increases have taken place in other Midwestern states. Numerous new fertilizer plants have been built in the Midwest in recent years, and others are being planned.

While there are numerous processes in use for manufacturing fertilizer, and many more have been proposed for large scale use, the optimum process is to a large extent dependent on the location of the plant and the region to be served. It was therefore felt that a research and development program in fertilizer manufacturing would serve the best interests of the farmers and fertilizer industry of the state and the entire Midwest.

The fertilizer manufacturing research program at Iowa State is under the direction of Dr. G. L. Bridger, Head of the Department of Chemical Engineering and the Chemical Engineering Section of the Engineering Experiment Station, who was formerly Chief of the Process Development Division at the Tennessee Valley Authority's Muscle Shoals Chemicals Plant. Another major staff member in the program is Dr. D. R. Boylan, Assistant Professor of Chemical Engineering, who had considerable industrial experience in the chemical field before joining the staff at Ames (Figure 1). The various projects are carried out with the assistance of graduate students who use the results of their investigations in partial fulfillment of the requirements for their Master's and Doctor's degrees; there have been on the average about six such graduate assistants at any one time. In addition there are numerous part-time undergraduate assistants carrying out the more routine phases of the investigations.

Figure 1: Dr. Bridger (left) and Dr. Boylan (right) discuss a fertilizer manufacturing research problem.

Adequate space is available for both small scale laboratory and moderate scale pilot plant investigations in the two chemical engineering buildings of the college. These buildings provide numerous small laboratories and larger areas for bench scale and pilot plant set-ups. Some of the laboratories are shown in Figs. 2 & 3.

One of the advantages of carrying out research on fertilizer manufacturing at Ames is the proximity of the outstanding Agriculture Division of the college. Excellent cooperation has been received from the Agronomy Department and other agricultural groups.

Developing New Processes

THE fertilizer manufacturing research program is concerned with developing new types of fertilizers and new production processes as well as making improvements in current fertilizer manufacturing processes. An example of a new type of fertilizer

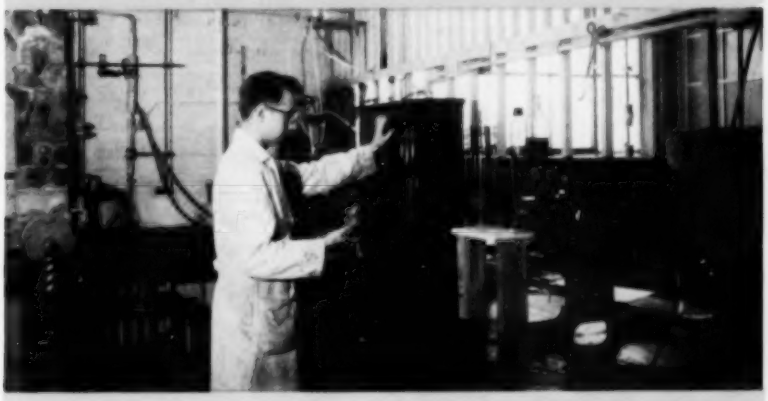
AT IOWA STATE COLLEGE

developed at Ames is fused potassium magnesium phosphate. It was found that by fusing phosphate rock with potassium and magnesium sulfates in the correct proportions, the P_2O_5 in the rock could be made available with little or no loss in water solubility of the potassium and magnesium. Since one of the commercial sources of potassium and magnesium sulfates is langbeinite ($K_2SO_4 \cdot 2MgSO_4$), sold commercially under the tradename "Sul-Po-Mag,"* this material was used in pilot plant studies of production of the fused fertilizer.

Successful pilot plant production was carried out in a fuel fired shaft furnace which is shown in Figure 4. The product contains about 12% available P_2O_5, 12% available K_2O, and 12% available MgO. The P_2O_5 is not water-soluble, but the potassium and magnesium are. It is believed that, as sulfur and sulfuric acid become more expensive, this process will find commercial application since these are not required in the fusion process. For some locations the process is believed to be competitive with other fertilizer processes at present. It is described in detail in a recent publication (2).

Figure 2. (top): One of the laboratories in which fundamental fertilizer research is carried out.

Figure 3 (bottom): Overall view of pilot plant where laboratory research is put to performance tests.



An example of a project to improve present fertilizer manufacturing processes is that of quick curing of superphosphate. At present most superphosphate plants cure the fresh product for several weeks before it can be used either in the formulation of mixed fertilizers or for direct application. An economical quick curing process would have many advantages over the present storage curing practice, the more important of which would be elimination of the large curing buildings and the large inventories of product required.

It was found in laboratory studies at Ames that, although fresh superphosphate made in the usual way is very difficult to dry without obtaining a high citrate-insoluble content in the product, by modifying the mixing conditions and by use of a special type of dryer — the Roto-Louvre dryer — it was possible to quick cure superphosphate and retain a reasonable P_2O_5 conversion. To do this it was found necessary to prepare the superphosphate with sulfuric acid of about 55% concentration instead of the usual 72% concentration.

The fresh superphosphate thus prepared can then be dried in a Roto-Louvre dryer at moderate temperatures to obtain a product of about 95% P_2O_5 conversion. Advantages of the Roto-Louvre dryer are that good heat economy is obtained at the moderate drying temperatures required to prevent overheating the product and that difficulties usually encountered in drying superphosphate caused by buildup of product in most conventional dryers are avoided in the Roto-Louvre.

*Product of International Minerals & Chemical Corp., Chicago.

The quick curing process is being studied in a pilot plant having a capacity of about two tons per day which is shown in Figure 5. The pilot plant operation has been quite successful and has substantiated results of small scale investigations which are presented in detail in a recent publication (4).

Progress in Fundamental Research

PROJECTS of a more fundamental nature are also of interest at Iowa State College. For example, a study was recently completed in cooperation with the Institute for Atomic Research of the College in which radioactive phosphoric acid was used to determine the source and distribution of P_2O_5 in triple superphosphate made under various conditions. It was demonstrated for the first time that the citrate-insoluble portion of triple superphosphate is derived entirely from phosphate rock and not from any reversion product of phosphoric acid. Numerous other conclusions were made regarding the distribution of the acid P_2O_5 and rock P_2O_5 in triple superphosphate. A paper describing this work was published recently (5).

Another project in phosphate fertilizers was a study comparing several Western phosphate rocks with Florida rock in the preparation of ordinary and triple superphosphate.

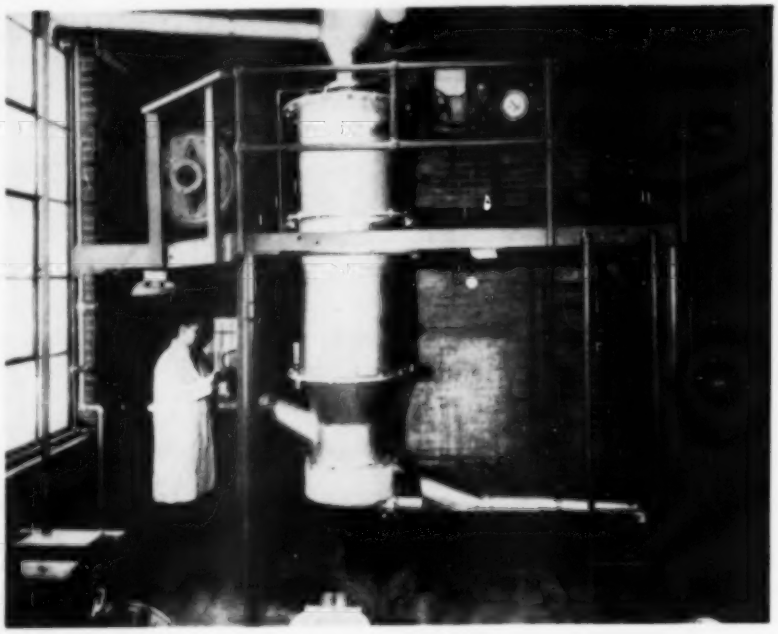
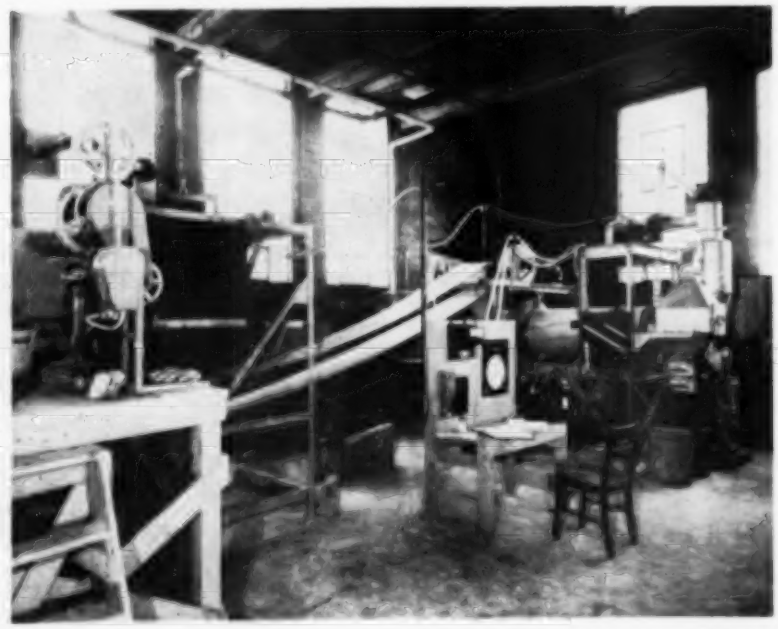


Figure 4 (top): Fused potassium magnesium phosphate is prepared in a fuel-fired shaft furnace in a pilot plant operation. The process is believed to be competitive with other fertilizer processes in current commercial use.

Figure 5 (bottom): Quick curing of superphosphate, by a new process which retains a reasonable P_2O_5 conversion, results in a form of superphosphate which can then be dried at moderate temperatures to yield a final product of about 95 per cent P_2O_5 conversion.



Attention has also been given to nitrogen fertilizers. A study was made of the ammoniation of corn cobs as a possible carrier of nitrogen. By subjecting the corn cobs to a mild sulfuric acid hydrolysis before ammoniation, it was found possible to obtain usable products containing up to 8% nitrogen, some of which gave good response as nitrogen fertilizers. However, the economics of such a process did not appear favorable. Other studies were made of the possibility of storing ammonia by adsorption on various materials. Although an economical process did not result, some of the data appeared to be useful and were recently published (6).

Occasionally it is necessary to develop or improve analytical procedures for fertilizers. For example, a colorimetric procedure for determination of P_2O_5 in fertilizers was developed (3), which appears to have certain advantages over previous methods of this type. Also, a bibliography of recent fertilizer analytical methods was published (1).

Attention is being given to alternate sources of sulfuric acid in case of future sulfur shortages. A project is under way on the thermal decomposition of gypsum and anhydrite

(*Continued on Page 121*)

GARDEN TRADE SHOW

Pesticide Manufacturers Display New Products at National Exhibit in Chicago

By H. H. Slawson

THE 8th National Garden Trade Show, at the Hotel Sherman, Chicago, Jan. 11-13, offered a number of manufacturers opportunity to make their first public showing of a varied assortment of new chemical specialties in consumer size packages for the home gardener. Some 209 exhibitors of garden supplies and equipment occupied all available space at the hotel and the attendance of over 3,000 dealers topped all records.

Contrasting sharply with last year's concentration on soil conditioners, the current show revealed a definite trend of interest in conveniently packaged plant foods. New ideas in this field included a "turf mender" combination composed of an organic base fertilizer, plus a lawn grass seed treated with disinfectant for protection from insects and disease.

Interest in packaged chemicals for insect, disease and weed control continues unabated, exhibitors indicated, and it is apparent that close attention is being given to market demands for containers of economical size, applicators for convenient utilization and educational materials to guide the home gardener in intelligent use of the chemicals.

Newest of these educational aids noted around the show was a "Garden Chemicals Product Selector," introduced by the Du Pont Co., Wilmington, which aids customers in selecting the particular Du Pont product available for control of a specific problem. If, for instance, the problem is aphids, you move a dial until "No. 5" appears in a slotted opening, where you learn that the Du Pont aphid and mite spray is what you need.

Monsanto Chemical Co., St. Louis, made their first public showing of two new garden products, "Bogey," a pesticide and fungicide dust, packaged in a 6 oz. gun-form applicator, and "D-Leet," a liquid weed killer available in 8 oz. and 32 oz. containers. Also featured was "Folium" water soluble fertilizer in 2 oz., 1 and 5 lb. containers, with an applicator. Due attention, too, was given Monsanto's "Krilium" soil conditioner.

American Cyanamid Co's agricultural chemicals division, New York, placed emphasis on their "Garden Cyanamid" which, after limited introduction last year, is now being pushed nationally, in 10, 25 and 50 lb. bags, through jobbers, who contact the retail trade. Also featured was the company's Malathion, which is offered to technical formulators in containers from 1 oz. bottles to 55 gallon drums. Among other products shown was the well-known "Cyanogas" ant killer and potassium cyanate crab grass killer for technical formulators.

Boyle-Midway Co., New York, made their first public showing of a month-old aerosol bomb for insect control on African violets and house plants, Featured, too, was an aerosol rose spray, using lindane, for aphids, Japanese beetles and other plant pests. Among other products shown were poisons for control of snails, slugs, ants, etc.

Goulard & Olena, Inc., Skillman, N. J., showed their full line of garden chemicals for insect and weed control, fertilizers, etc. and announced a new product "Hopewell Valley Good Earth," a potting soil for household and nursery plants. Alec Goulard, president, said that, to avoid confusion with other products, their herbicide and fertilizer combination has been rechristened "Go-Weed." In a repackaging program under way chemicals formerly packed in tin will be distributed hereafter in 5 and 10 lb. bags with polyethylene liners. This, it was explained will eliminate trouble caused by reaction of the chemicals with the tin in the older containers.

Swift & Co., Chicago, made their first showing of a new "End-O-

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Typical of the displays at the Chicago Garden Show was this booth of Goulard & Olena, Skillman, N. J., showing their full line of home garden specialties.

ISOTOPES

their use in fungicidal research

By S. E. A. McCallan*

ALTHOUGH radioactive isotopes have been used in biological experiments in a limited way for many years, it has been only since the development of the nuclear reactor that they have become generally available on a large scale for physiological and biochemical investigations. Radioisotopes furnish the investigator with two very important advantages based on the following characteristics: (a) the giving off of radiation is a physical property of the atom which is not altered, no matter how many chemical reactions the atom may undergo; and (b) in measuring the radiation, one is dealing with individual atoms and therefore the isotope can still be detected after a large amount of dilution.

It is apparent that by making use of these two factors, many problems of interest to plant pathologists, including those concerned with fungicides, which formerly seemed to offer formidable obstacles, can now be attacked. Later on several examples of such problems will be given, but first a few words more about the nature of the isotopes useful in biological investigations.

Using Radioactive Isotopes

RADIOACTIVE isotopes, as may be recalled, are atoms which contain a different and unstable number of neutrons in their nucleus. These radioactive atoms give off radiation in the process of transformation to a more stable state. The radiation consists of alpha, beta, and gamma rays. In using radioisotopes in biological experiments, one is generally concerned only with beta and gamma rays. The beta rays are high speed electrons while the gamma rays are photons, as are X-rays. The conventional Geiger-Müller tubes and scaling units permit quantitative determination of the radiation being given off. While not every atomic disintegration is measured with the usual procedures, a fair percentage is recorded. This fact indicates the great amount of dilution that can be involved in experiments when radioactive isotopes are used as tracers. It is, therefore, apparent that factors other than dilution will control the use that can be made of radioactive isotopes in most instances.

It should be pointed out that many preparations of radioactive isotopes involve a considerable amount of dilution before they are received by the potential user. This is especially true of organic compounds labeled with C^{14}. It is important when one is considering the use of isotopes that the preparation available will allow the dilution required in the experiments planned. Some of the inorganic fungicides of interest to plant pathologists are available carrier-free so that considerable dilution is necessary before practical experiments can even be started. The specific activity, *i.e.*, the amount of radioactivity per unit weight, is the unit used to express this characteristic of radioactive materials.

Most of the elements of interest in fungicide studies are available in suitable radioactive form. Examples are carbon, sulfur, copper, silver, cadmium, and mercury. The use of copper entails some difficulty because of its rapid decay. The elements, nitrogen and oxygen, cannot be obtained in radioactive form with suitable half-lives and the radioactive isotope of hydrogen, tritium, has limited usefulness because of the low energy of its radiation. The procurement of organic fungicides labeled with C^{14} is often involved because of the amount of development work required before a suitably labeled compound can be synthesized.

Results With fungicides

PERHAPS the first studies in which a radioactive isotope of interest as a fungicide was used were those of Turrell and Chervenak in 1949 (6). The workers were investigating the phytocidal effect of sulfur 35 applied to lemons. They found that a very large percentage of the sulfur in the hydrogen sulfide formed when the lemons were incubated at 106° F., was derived from the applied sulfur. The radioactive sulfur was also found in the sulfate of the peel and incorporation with the tissue proteins was also indicated. Similar results were obtained when the lemons were exposed to sulfur vapor.

Yarwood and Jacobson (8) studied the uptake of vapor from a solution of sodium sulfide containing S^{35}, by bean leaves infected with the uredinial stage of *Uromyces phaseoli* or with *Erysiphe polygoni*, and by

*From a talk given at the 45th Annual Meeting of the American Phytopathological Society, Madison, Wisconsin, September 7, 1953, based in part on results obtained in investigations carried out in cooperation with the United States Atomic Energy Commission, Contract AT(30-1)-788.

sunflower leaves infected with *Puccinia helianthi*. They found that the isotope taken up by mildewed and rusted areas was up to five times that of normal areas of the same leaves. Sufficient vapor was taken up to kill the parasites although the host remained uninjured.

Later, their work (9) on selective uptake was extended to include more organisms and relatively inert $Cs^{137}Cl$ in addition to the toxicant H_2S^{35}, and the nutrients $H_3P^{32}O_4$ and C^{14} sucrose. In most instances absorption was greater in the diseased areas for both toxicants and nutrients, although in one instance the organism took up less sulfur than the host tissue and was still killed by it.

In our own experiments, when lilac leaves infected with powdery mildew were exposed to the vapor of elemental sulfur, considerably more of the radioactivity was evident in the infected areas as indicated by radioautographs. Increased radioactivity seemed to be associated with the mycelium. There is also the possibility that tissue under the mycelium injured by the mildew takes up more vapor than healthy tissue. Leaves injured mechanically will take up more sulfur in the affected areas under these experimental conditions.

Using radioactive sulfur, we reexamined the question of the toxicity of sulfur to fungus spores (3). Spores of various species of fungi when exposed to sulfur vapor took up relatively large quantities as determined by radioactivity counts. These quantities were much larger than those taken up by a variety of other materials exposed at the same time. When the uptake of sulfur and release of hydrogen sulfide by spores was studied quantitatively with the use of radioactive sulfur and by conventional chemical methods, it was found that the sulfur taken up by spores is given off as HS.

The quantities of hydrogen sulfide that spores could give off before their ability to germinate was seriously impaired was found to be very high on a spore weight basis, 5000 p.p.m. and higher. Spores of two species, *Neurospora crassa* and *Cephalosporium acremonium*, gave off from 22,000 to 54,000 p.p.m. before their germination was completely inhibited. On the basis of these studies it was concluded that the role of hydrogen sulfide in the toxicity of sulfur was not as great as was thought previously. It was suggested that sulfur may exert its effect through its action as a hydrogen acceptor and therefore its interference in the normal dehydrogenation and hydrogenation reactions.

In fungicide investigations the question arises as to whether any of the fungicide or any part of the fungicide molecule enters the host plant. To answer this question is exceedingly difficult by ordinary analytical means, especially if one is dealing with a constituent that is already present in the plant and absorption would merely add a little more to a much larger quantity already present. Thus if one wishes to determine whether any sulfur from ferbam enters a treated plant it would be a difficult statistical problem to determine whether treated plants contain a significantly larger amount of sulfur. Labeled sulfur simplifies this problem.

Our experiments (7) have shown that carbon disulfide is given off even by dry ferbam and is taken into plants and metabolized so that the sulfur from the disulfide can be found in the various sulfur fractions. This, of course, does not give the whole answer to absorption of ferbam and this example may be used to point out that when a labeled compound is used it is only the radioactive atom that is being followed.

There is a lot more to the molecule of ferbam than sulfur. One might also label the carbon in the dimethylamine part of the molecule and then one could follow the fate of this part of the molecule if taken into the plant. Efforts were made to obtain C^{14} labeled dimethylamine and it was found to be unavailable. The question of absorption of the intact molecules of such unstable compounds as ferbam and nabam by green plants is probably academic since they would not be expected to persist unaltered at the pH values found in plants (2, 7).

Extensive use of radioisotopes has been made in studies (4) designed to determine the amount of toxicant necessary to inhibit germination of fungus spores. Early experiments along these lines showed that the dose received by the spores was markedly greater than indicated by the concentration of the applied solution.

Accordingly, the rate of uptake, dose received, and the toxicity on a spore weight basis were determined for 2-heptadecyl-2-imidazoline, ferric dimethyldithiocarbamate (ferbam), silver, and cerium. Spores of 10 species were included. The uptake of the imidazoline, cerium, and silver was in all instances very rapid; a large percentage of the total quantity taken up was removed in 30 seconds or less. High doses were required for germination to be inhibited. The accumulation was most marked with 2-heptadecyl-2-imidazoline; it could amount to as much as 10,000-fold. The ED50 values on a spore weight basis were 9250 and 5800 p.p.m. for *Venturia pyrina* and *Neurospora sitophila*, respectively.

With silver, ED50 values from 85 to 540 p.p.m. were obtained for spores of four species of fungi. These doses were taken up from solutions containing only 1.04 p.p.m. Cerium was found to be toxic only to spores of *Monilinia fructicola* with an ED50 value of 4600 p.p.m. Spores of *Aspergillus niger* took up cerium to a much greater degree but were unaffected by it.

Some experiments have also been carried out (5) in which spores were exposed to the imidazoline, silver, and cerium simultaneously or consecutively. These have shown that the uptake of one toxicant does not affect the uptake of a second toxicant in such exposures, thus the receptor sites in the spores are different for the toxicants in question.

Thus by the use of radioactive isotopes, it has been possible to determine what might be called true dosage-response curves. That is, the percentage germination can be related

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Ag. Chemical Problems Discussed at NW Chemical Peddlers Clinic

By Charles H. Starker

THE first annual meeting of the Pacific Northwest Agricultural Chemical Peddlers Clinic got off to a fine start under the guidance of Dr. R. D. Eichmann, Stauffer Chemical Company, Portland, at the Benson Hotel, Portland Ore., on January 18-20. This meeting was organized under the sponsorship of the Western Agricultural Chemicals Association to more effectively utilize the time of industry sales and research personnel in the intervals between the open meetings of the Vegetable and Spray Conferences, held annually in Portland. The program brought a variety of talent to the three-day session and covered several topics of interest to the agricultural chemicals indu try which normally are not included in the Vegetable or Spray Conference. (See story page 77)

Dr. Eichmann, who is arrangements chairman for the Pacific Slope Branch, Entomological Society of America, announced that the summer meetings of that group would be held in Bend, Oregon June 22, 23 and 24 with headquarters at the Pilot Butte Inn. His committee is working out itineraries for trips to various scenic spots in the area.

In the technical sessions Frank Lieberman, USDA Legume Research Investigations, Logan, Utah, opened discussions on alfalfa insects. He told the group that at comparable rates, sprays were more effective than dusts for alfalfa weevil control, heptachlor being the only exception to this trend. Systox applied for control of seed chalcids gave poor results. Cultural methods hold the most promise at present. Toxaphene is recommended for control of lygus bugs on blooming alfalfa over DDT, for greater safety to pollinating insects.

"The Balance of Nature is long gone," Dr. Wm. C. Cook, USDA entomologist from Walla Walla, Wis., told the group. He indicated our present insect problems stem from several sources, especially in "one crop" areas. When virgin land is plowed up, and cultivated crops planted, those insects which feed on native vegetation are usually forced to leave, and their place is later taken by a high concentration of pests which feed on the cultivated crops.

Present day consumer demand forces the grower to produce a higher percentage of practically perfect produce, which means more applications of the most effective insecticides.

Toxicology of Insecticides

"No material is completely harmless, even air when injected into a person's veins can cause sudden death" stated Dr. Wm. M. Upholt, U. S. Public Health Service, Wenatchee, Wis. None of the materials now in use are so dangerous we can't use them, nor are any of them completely safe. Field work in Wenatchee last season indicated dermal exposure to organic phosphates was more hazardous than respiratory exposure. Field use of non-dusting type parathion wettable powder showed the formulation was successful in keeping down the concentration of parathion in the air.

Cereal Seed Disinfectants

"Some form of seed disinfectant has been in use on cereal crops since the accidental discovery some 300 years ago in England that sea water would inhibit smut on wheat," Dr. C. S. Holton, USDA cereal pathologist, Pullman, Wn, declared. Copper sulfate came into use about 100 years after the salt water treatment, and some sixty years ago formaldehyde became popular as it was cheaper and gave less seed injury than other materials then in use. Copper carbonate, the first "dry" material, came into vogue about 1920. Mercury materials were later developed with some advantages, but had the disadvantage of being both poisonous and difficult to handle.

Treating seeds with a "dry" fungicide introduced a dust problem, so the "slurry" method was evolved to take care of the situation, but after seed is treated by this process and dries, it still tends to dust to some extent.

New liquid fungicides show considerable promise for the future . . . particularly the liquid mercury products. Certain non-mercury materials . . . the polychlor benzines . . . are also promising. Some are non-

(*Turn to Page* 137)

Left Photo: Dr. L. H. Purdy and Dr. C. S. Holton, USDA, Cereal Seed Pathology Investigations, Pullman, Wisc.

Center Photo: R. W. Every, Ore. State College, Corvallis, Ore.; D. H. Brannon, WSC, Pullman, Wisc.; and R. D. Eichmann, Stauffer Chem. Co., Portland, Ore.

Right Photo: Gaines W. Eddy and Robert A. Hoffman both of U.S.D.A., Corvallis, Ore.

Mayfield Urges "*BUY EARLY PROGRAM*" at Cotton States ESA Meeting in Biloxi

New Officers for 1954: left, W. G. Bruce, regional director, Plant Pest Control Branch, USDA, chairman; and Dr. W. G. Eden, Alabama Polytechnic Institute, Auburn, Ala., secretary-treasurer.

MORE than 150 members and guests registered at the 28th annual meeting of the Cotton States Branch of ESA held at the Buena Vista Hotel in Biloxi, Miss., January 25-27th. W. G. Bruce, USDA, Gulfport, Miss., was elected chairman of the section for 1954, succeeding Dr. F. S. Arant, Alabama Polytechnic Institute, Auburn. Other officers elected were: vice-chairman, Dr. J. G. Watts, South Carolina Agricultural Experiment Station, Blackville, S. C., succeeding H. C. Young, Florala, Ala.; and secretary-treasurer, Dr. W. G. Eden, Alabama Polytechnic Institute, Auburn, succeeding Dr. L. C. Murphree, Coahoma Chemical Co., Clarksdale, Miss.

In his opening address, chairman F. S. Arant pointed out that although phenomenal progress has been made in insect control, the importance of insect damage to agricultural crops has increased continuously during the past 30 years. He reminded the group that a sound program of education and cooperation is of prime importance in increasing agricultural production.

Dr. H. H. Ross, president of the Entomological Society of America, discussed the functions of the society, stating that one phase is to maintain and improve an adequate communication system for American entomologists on a national scale.

Paul Mayfield, Hercules Powder Co., Wilmington, Del., president of the National Agricultural Chemicals Association, discussed the many problems confronting not only the entomologist, but manufacturers of pesticides also. He reviewed the current concern being expressed in many quarters on the question of toxicity hazard in connection with pesticide use, and reminded his listeners that "the spotlight is upon the work the entomologists do in controlling insects . . . just as brightly as it shines upon the work pesticide manufacturers do in producing and developing pesticides.

"The pesticide manufacturer, therefore, has much the same problem. He must see to it that the spotlight shines favorably. He must tell the public how the use of pesticides has produced more food, how it has reduced the loss in human life from diseases like malaria, how it has increased our standard of living.

"Even more important, he must show that pesticides are able to be used without endangering public health. He must emphasize that the entomologist and the pesticide manufacturer are fully aware of their responsibility to the American people and have worked closely with Federal and State legislators to secure the adequate legal protection now in existence that assures the public a safe food supply. He must show the public how pesticides carry all necessary precautions as to their proper and safe use. He must explain that for a pesticide to be sold in interstate commerce, it must be registered by the United States Department of Agriculture. He must explain, further, that in order to obtain such registration, the manufacturer must prove that the material, used according to directions, will give effective control without harming the crop or the individual applicator, nor will it leave residues of the chemical on the plant that will be harmful to consumers of food products."

Mr. Mayfield also emphasized the tremendous possibilities in expanding the market for pesticides through a program of education of pesticide

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Left: Dr. H. H. Ross, president of the Entomological Society of America; Center: Paul Mayfield, president of the National Agricultural Chemicals Association; Right: F. S. Arant, 1953 chairman of the Cotton States Branch, E.S.A.

THE "NIGHTCAP" WITH A KNOCKOUT

GEIGY METHOXYCHLOR FORMULATIONS

they're positively deadly to bugs!

Ever see a covey of bugs fly unscathed through a cloud of insecticide like they had radar? Or see them shake off a direct hit and amble away unharmed and unconcerned? That's the time to start specifying GEIGY METHOXYCHLOR, the chemicals that are positively deadly to pests but relatively safe to human beings and animals. GEIGY METHOXYCHLOR products are effective for fly control, storage pests and for fruit, vegetable and forage crops. They are available as the following:

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(25% emulsifiable solution—
2 lbs. methoxychlor per gal.)

GEIGY METHOXYCHLOR "90"
(90% methoxychlor)

GEIGY METHOXYCHLOR "20"
(20% methoxychlor solution)

GEIGY METHOXYCHLOR "50"
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TVA ISSUES '53 REPORT

Development of Electric Furnace and Smelting of Phosphates Listed Among 20th Year Achievements

A REPORT on its 20th year, with special emphasis on its contributions to the fertilizer industry, was issued last month by the Tennessee Valley Authority.

The report, published in an attractive booklet, contains 82 pages of text material and a supplement of 89 pages including financial statements and other statistical data.

Two chapters in the report deal specifically with fertilizer development and applications. One covers chemical engineering and resource development, while the other is concerned with uses of TVA fertilizer.

In summarizing its financial position for the fiscal year ended June 30, 1953, TVA reports gross income of $3,383,369, based on costs of $16,838,439 and income of $20,221,708 without allowance for research costs. The figures apply to sales of fertilizers and munitions.

Citing first its role in national defense (TVA supplied the electric energy which first released "the awful power of the atom") the report gives a complete summary of activities in the fertilizer field.

TVA sets forth its objective at Muscle Shoals as two-fold "One," it states, "is to develop fertilizer materials which can be economically and effectively used by the farmer to increase production and to build up and conserve the soil. The second is to devise processes and equipment which will enable manufacturers to produce the kind of fertilizers farmers need, at costs they can afford to pay, and at the same time make the best and most economical use of the raw material from which the fertilizers are made."

The report asserts TVA's chemical engineering research, particularly in phosphate technology, has been of value to private industry. One of the most notable achievements, according to the report, has been the large-scale development of electric furnace smelting of phosphates, which has made it possible to use lower-grade ores and thus to extend the life of the national phosphate reserves.

More than 100 patents relating to processes and equipment, have been licensed by the Authority, four of them during 1953. These are licensed free to industry, and information on research results is widely disseminated.

The report tells about committees of NFA which conferred with TVA several times last year, and mentions the large number of visitors who have sought technical information at the facilities, particularly on ammoniating superphosphates. TVA currently is carrying out a project to make fertilizers and at the same time extract uranium from certain Florida phosphates, on the request of the Atomic Energy Commission.

The report goes on to summarize activities in these fields of interest to the industry:

1. Phosphoric Acid — Conducting pilot plant operations to develop a method of producing "wet process" phosphoric acid from low-grade phosphates.

2. Nitric Phosphates—During 1953, TVA successfully completed pilot plant work on the fourth major nitric phosphate process for producing high concentration fertilizer containing both phosphorus and nitrogen. Nitrogen Division, Allied Chemical & Dye Corp. and Associated Cooperatives, Inc., Sheffield, Ala., both have nitric phosphate plants under construction, having obtained process information from TVA.

3. Diammonium Phosphates—Pilot plant studies were made of a process for producing the material, containing approximately 18 per cent nitrogen and 50 per cent P_2O_5. It has high concentration and is water-soluble.

4. Continuous Ammoniation—Continuous method of ammoniating superphosphates and fertilizers was developed in 1953 "as a means of assisting the industry to get more low-cost nitrogen into fertilizers."

The report also reviews research performed on calcium metaphosphate, fused tricalcium phosphate, ammonia and ammonium nitrate.

It describes the various uses of these fertilizers and states that the products from large-scale operations are used strategically "in accord with the recommendation of the landgrant colleges to show the farmers the need for and proper use of fertilizers and to further the conservation of soil and the protection of watersheds."

"Thus used," the report continues, "they help to create a demand for new and improved fertilizers which it then becomes the responsibility of private industry to fulfill."

Results of 1953

FUNGICIDE TESTS

Continuing the summary of reports on fungicide tests by 75 collaborating pathologists who have cooperated by mailing reports of their work and their findings during the 1953 season to a committee of the American Phytopathological Society. This special Advisory Committee on Collecting and Disseminating Data on New Fungicide Tests, of which Dr. L. G. Utter, Diamond Alkali Co., Newark, N. J. is chairman, has made arrangements for reprinting the complete report after publication is completed (which will be in March). Reprints may be ordered at $1.00 per copy, through Dr. W. D. Mill, Dept. Plant Pathology, College of Agriculture, Ithaca, N. Y. Test results were assembled and summarized by Dr. A. G. Newhall of the New York State Agr. Experiment Station, at Cornell University, Ithaca, N. Y.

Tree Fruits

Apricot (Derby Royal)

Brown rot (blossom blight) *(Monilinia laxa)*. Davis, California. Harley English. Replicated orchard plots were sprayed at 500 gals. per acre per season when blossoms were 10% open. Incidence of disease was light with marked tree-to-tree variation; but "on the basis of this test, Vancide 51ZW, Velsicol 50-CS-46, and Cunilate 2472 probably are not worthy of further trial."

	Per 100 gals.	DC
Phygon XL	¾ lb.	
Orthocide 50 wettable	2 lb.	1
Zerlate + spreader*	2 lb.	
Manzate + spreader*	2 lb.	1
Dithane D14 + FeSO4	½ gal.	
Dithane D14 + FeSO4	12 oz.	1
Dithane D14 + FeSO4 + ZnSO4	½gal.	
Dithane D14 + FeSO4 + ZnSO4	5 oz. + 6 oz.	1
Mathieson Bulb Fungicide No. 275	6 lbs.	2
Crag Fungicide No. 640	1½ lbs.	
Tag	½ pt.	2
Mereuline 100	½ pt.	
Copper A	5 lbs.	2
Bordeaux	10-10-100	2
Vancide 51ZW	2 lbs.	
Velsicol 50-CS-46	½ pt.	2
Cunilate No. 2472	3 lbs.	2

*1½ oz./100 gallons of DuPont Spreader Sticker.

Avocado (Fuerte)

Dothiorella fruit rot *(Botryosphaeria ribis)*. Riverside, California. G. A. Zentmyer and W. A. Thorn. Field plots sprayed 2 or 3 times with power sprayer September, November and December 1952. Cuprocide used at approximately 12# per acre per application.

	lbs./100 gal.	DC	PS	OP
Yellow Cuprocide	2 (2 sprays)	1	1	1
Yellow Cuprocide	2 (3 ")	1	1	
Manzate	2 (2 ")	2		

Peach (Elberta and ViDette)

Brown rot *(Sclerotinia fructicola)*. St. Catharines, Ontario. G. C. Chamberlain. Six applications of spray beginning with pre-pink resulted in the following ratings.

	lbs./100 gal.	DC	PS	OP
Orthocide	2	1	1	1
Colsul	8	2	1	2
Vancide 51 + Zinc	3-1	2	1	3
Crag	1½ qts.	3	1	4

Peach ("Brunett" Elberta)

Brown rot *(Sclerotinia fructicola)*. Gramling, South Carolina. H. H. Foster. Seven applications were made to 7 randomized single tree plots beginning with petal fall. Orthophos used with Orthocide, but Parathion in all other materials in each application. Data again was taken from ½ bu. samples from each tree after holding 5 days at 75-80°F. As indicated in the following table wettable sulfur appeared somewhat superior in brown rot control.

	lbs./100 gal.	Total Peaches Harvested	% Healthy	% Brown Rot	% Scab
Wettable sulfur	6	570	94.3	5.6	0
Orthocide 50	2	608	89.1	10.8	0
Orthocide 50 + Orthophos	2	669	91.1	8.2	0.4
Carbide & Carbon 5400	2	663	88.3	9.6	2.0
Manzate	1½	613	86.6	12.7	0.6
No fungicide		614	34.8	62.2	2.6

Peach (Halo)

Fruit rot *(Rhyzopus)*. Inman, S. Carolina. H. H. Foster. Seven applications were made to 5 randomized single tree plots. Parathion was used in all sprays, but Orthocide HL 673. Data was obtained from ½ bu. samples from each tree after holding 6 days at room temperature.

"In these experiments, peaches sprayed with wettable sulfur showed an excessive amount of injury, apparently caused by a combination of high temperature and sulfur spray burn. Rhizopus infection frequently followed these injuries. Peaches sprayed with Orthocide showed very few brown rot symptoms and the fruit finish was excellent. In addition to the Orthocide treatments, Manzate and Rohm & Haas L.O. 737 were among the more promising compounds tested. Velsicol 48-CS-73 at the two pound rate, induced severe foliage and fruit injury, consequently, it was discontinued. Penn Salt NP-770 appeared to inhibit the development of the normal red color in peaches."

	lb./100 gal.	Peaches Harvested	% Healthy	% Brown Rot	% Scab	% Rhizopus*
W.S.	6 lbs.	708	64.6	1.1	0.1	33.1
W.S.	6 lbs.	660	85.1	1.2	0	13.6
(Final 4 sprays Orthocide)	2 lbs.					
Manzate	2 lbs.	606	96.0	0.8	0	3.1
Orthocide	2 lbs.	652	91.4	0.1	0	8.4
Ortho. H.L. 673 (package spray)	3 lbs.	639	90.9	0.3	0	8.7
Ortho (special M.)	2 lbs.	628	92.6	0.1	0	6.2
Penn Salt N.P. 770	1-6/10 qt.	521	89.4	3.0	0.5	6.5
Crag 341 (Reduced to 1 qt. in 2 final sprays)	1½qts.	621	64.7	3.2	0.3	31.5
R & H L.O.— 737	2 lbs.	629	95.0	1.5	0	3.1
R & H L.O. 738	2 lbs.	696	81.7	3.1	0.1	14.8
Velsicol 48-CS-73 (2 final sprays Orthocide)	2 lbs.	481	0.0	6.4	91.6	2.4
	2 lbs.					
Velsicol 48-CS-36	2 lbs.	643	76.8	6.5	4.5	12.1
Parathion	2 lbs.	665	51.2	21.8	3.4	22.7

*The percentage for undetermined rots was omitted, consequently, the total percentage does not equal 100.

DC Degree of Control.
PS Plant Safety.
OP Operators Preference.
Y Yield.

Peach (Jerseyland)

Scab *(Cladosporium carpophylum)*. South Carolina. H. H. Foster, R. J. Higdon, J. H. Riley. Seven applications were made to 7 randomized single tree plots. Parathion was used in all sprays. "Scab was severe on the checks. No brown rot appeared. Excellent control of scab was obtained with wettable sulfur and with Orthocide 50 and Vancide F 956, but not F 995." Data was secured from ½ bu. samples of fruit from each tree after holding 4 days at 75°F.

	Total Peaches	% Healthy	% Scab	% Rhizopus
Wettable Sulfur 6/100	596	95.3	0.0	4.6
Orthocide-50 Wettable 2/100	605	97.3	0.0	2.6
Vancide F-995 2/100	581	46.2	48.7	4.9
Vancide F-956 2/100				
1st 3 applications, Manzate 2/100 remainder of schedule	619	72.2	0.4	27.3
Wettable Sulfur 6/100 omitted petal-fall application	618	88.0	0.0	11.9
No fungicide	617	0.4	83.8	15.7

Peach (Johnson, Walton, Stuart)

Brown rot *(Sclerotinia fructicola)*. California. Joseph M. Agawa. One application at 180-200 gal. per acre one to two weeks before harvest, to small field plots, with power sprayer and hand sprayer resulted in the following rating. No materials caused injury.

	Amt./100 gals.	DC	OP
Captan	2	1	1
Ziram	2	2	2
Mathieson #275	6	3	3
Wettable sulfur	6	4	4
Purex (Hse-hold) Na hypochlorite	1 gal.	5	4

Pear (Forelle)

Fire blight *(Erwinia amylovora)*. Hood River, Oregon. J. R. Kienholz. Applications of the following materials were made with power sprayer to 8 single tree replicates. Streptomycin caused slight leaf chlorosis. Copper caused fruit russeting.

		DC	PS	OP
Unsprayed Checks		5	1	—
Streptomycin STS at 49 gm-80 gal. + 142cc Tween	Bloom-Calyx application	3	3	7
Streptomycin ST 325 at 101 gm-80 gal. + 142cc Tween	10 gal. per tree	4	2	—
Parzate 2-100		2	2	1
Copper Oxychloride	1-100	1	4	5

Apple (McIntosh)

Scab *(Venturia inaequalis)*. St. Catharines, Canada. G. C. Chamberlain. The following materials were compared and rated, using hydraulic sprayer.

	Amt./100 Imp g.	DC	PS	OP
Fixtan*	½ lb.	1	1	1
Coromere*	½ lb.	1	1	1
Tag*	½ pt.	2	1	1
Orthocide	2 lb.	3	1	2
Dithane 78	2 lb.	4	2	3
Nirit (thiocyono-dinitrobenzene	2½ lb.	4	4	4
Crag	1½ qt.	5	3	5
Dithane 14 & Sul.	1½ pt. + Sul 4 lb.	7	3	6
Vancide 995 (Man.salt)	2 lb.	5	2	6
Magnetic sul. "70"	8 lb.	7	3	6
Colsul Sul. "40"	8 lb.	7	3	6
Kolo-100	4½ lb.	6	3	6
Mercuramide*	½ pt.	5		

*Ferbam in cover sprays.

Apple (McIntosh, Delicious)

Scab *(Venturia inaequalis)*. Summerland, British Columbia. D. L. McIntosh, C. V. G. Morgan, J. E. Swales. Seven applications of the following materials were made to orchard plots with concentrate sprayer, applying 100 gallons per acre, beginning with pre-pink and including 4 cover sprays. "Crag 341 combined with malathion emulsion (6 qts. + 1 lb. lime + 5 pints per acre) produced fruit injury in the form of a brown blotch on the underside of the fruit of McIntosh, Delicious, Winesap, Newtown apples, and Bartlett pears."

	Amt./100 gal.	DC	OP
Manzate	10 lb.	1	1
Ferbam-sulfur	4 lb. + 12 lb.	3	2
L.S. plus DN 2 plus lime	8 gal + 3 lb. + 6 lb.	4	3
Ferbam	10 lb.	5	4
Captan	10 lb.	2	5
Crag 341 with lime	6 qts. + 1 lb.	6	6

In addition to scab control, the following information on the control of early red and yellow spider mites was secured. Counts are in mites per leaf to July 29. Mite sprays and DDT were omitted.

	Average 6 counts to July 29	E. red mites per leaf	Yellow spider mites/leaf
Lime sulfur	8 gals. + DN #2, 3 lb., + lime 6 lb.	5.98	1.16
Ferbam	#4 plus sulfur 12#	7.43	3.67
Glyodin (Crag 341)	6 qt. + lime 1#	25.79	39.62
Captan	10#	8.57	57.80
Manzate	10#	1.63	0.68
Ferbam	10#	13.80	1.87
No spray		71.59	35.93

Apple (Cortland, Jonathan, Wagner)

Scab *(Venturia inaequalis)*. Nova Scotia, Canada. J. F. Hockey and R. G. Ross. Six applications of 5 materials were compared at 1X and 6X concentrations. These were made between 2 Bordeaux applications, a 5-10-100 at delayed dormant, and a 3-10-100 at the second cover spray. "A mixture of Crag and Tag eradicant produced the best finish on all varieties. Colsul gave very poor control at 6X and does not appear to be worthy of further trial at the amount used." Crag 341 plus Mercury at 1X seemed to be best for scab control and safety.

	Amt./100 gal.	DC	PS	OP
Crag—Erad. (Tag)*	¾ qt. 1X	1	1	1
Captan	2 lbs. 1X	4	2	2
Magnetic 70	9 lbs. 6 lbs. after 1X calyx	2	3	3
Flotation sulfur	15 lbs. 12 lbs. after 1X calyx	3	3	4
Crag.-Erad.**	6X	7	1	5
Captan	12 lbs. 6X	8	2	6
Magnetic 70	70 lbs. 30 lbs. 6X after calyx	6	3	7
Colsul	8 ozs. 1X	5	3	8
Flotation sulfur	48 lbs. 40 lbs. 6X after calyx	9	3	9
Colsul	40 lbs. 6X	10	3	10

*Crag 341, ¾ qt. + 1½ oz. lime + Tag Erad. ¼ pt. used up to calyx. After calyx Crag 1 qt. + 2 oz. of lime was used.
**Crag 341, 4½ qts. + 9 oz. lime + Erad. 1½ pt. After Calyx, Crag 1½ gal. + 12 oz. lime.

Apple (McIntosh, Cortland, Red Delicious)

Scab *(Venturia inaequalis)*. Durham, New Hampshire. A. E. Rich, R. Eggert, J. D. Bilbruck, H. V. Toko. The following sprays at 1X concentration were applied with power sprayer as protectants ahead of wet periods except for Puratized and 50-CS-46. "The last named dwarfed the fruit and caused some foliage injury. Severe russeting was caused by 48-CS-73 which is probably not worth further testing. HB 160 was too hot at 4 lbs., resulting in severe thinning, but possibly can be used at lower concentration."

	lbs./100 gal.	DC	PS	OP
Captan	2 lb. thru 1st cover 1 lb. rest of season	3	1	1
Crag	1½ qt. thru 1st cover 1 qt. rest of season	3	2	2
Puratized Agr. Spray	1 pt. thru 1st cover followed by Captan	2	3	3
Zineb	2 lb. thru 1st cover 1 lb. rest of season	4	4	4
Phygon	½ lb. thru 1st cover followed by Captan	1	7	5
Ethyl B622	2 lb. thru 1st cover 1 lb. in other cover sprays	1	6	6
Sulfur	8 lb. sulfur paste thru 1st cover 6 lb. wettable sulfur rest of season	5	5	7
50-CS-46	2 oz. thru 1st cover followed by Captan	1	8	8
HB 160	4 lb. thru 1st cover followed by Captan	1	9	9

In another test at Durham, New Hampshire, the same workers obtained the following results.

Treatment (Thru 1st cover)	(2nd thru 6th cover)	% Leaf Scab	Fruit Scab McIntosh	Cortland
4 lb. H.B. 160	1 lb. Captan	½		0
2 oz. Velsicol 46	1 lb. Captan	¼	2	0
2 lbs. Ethyl B622	1 lb. Captan	¾	2	1
½ lb. Phygon	1 lb. Captan	¼	3	6
1½ qt. Crag 341	1 qt. Crag 341	2	4	2
1 pt. Pur. Agr. Spray	1 lb. Captan	1	6	2
2 lb. Captan	1 lb. Captan	4	5	0
4 lb. Sulfur + ½ lb. Captan	1 lb. Captan	7	6	4
2 lb. Zineb	1 lb. Zineb	11	10	2
8 lbs. Sulfur Paste	6 lb. wettable Sulfur	24	44	4
0.2 lb. Velsicol 36	1 lb. Captan	15	18.5	9
8 lb. Sulfur Paste	1 lb. Captan	14	23.0	4.5
2 lb. Velsicol 72	1 lb. Captan	12	36.5	16
Check		66	100	100

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Apple

Scab *(Venturia inaequalis)*. In another test at Durham, N. H., including several newer compounds, the same workers—Rich, Eggert, Bilbruck and Toko—obtained the following results:

Treatment		% Leaf Scab 6/23	Fruit Scab	
Thru 1st cover	2nd, thru 6th cover		McIntosh	Cortland
8 lb. Sulfur Paste	1 lb. Captan	14	23.0	4.5
½ lb. Phygon	1 lb. Captan	¼	3	0
8 lb. Sulfur Paste	6 lb. wettable sulfur	24	14	4
4 lb. Sulfur + ½ lb. Captan	1 lb. Captan	7	6	4
2 lb. Captan	1 lb. Captan	4	5.5	0
1½ qt. Crag 341	1 qt. Crag 341	2	4	2
2 lb. Zineb	1 lb. Zineb	11	10	2
2 lb. Exp. Fung. 622	1 lb. Exp. Fung. 622	¼	2	1
4 lb. Exp. Fung. 160	1 lb. Captan	½		0
0.2 lb. Exp. Fung. 36	1 lb. Captan	15	18.5	9
2 lb. Exp. Fung. 73	1 lb. Captan	12	36.5	16
1 pt. Pur. Agr. Spray	1 lb. Captan	1	6	2
2 oz. Exp. Fung. 46	1 lb. Captan	¼	2	0
Check		66	100	100

Apple (McIntosh)

Scab *(Venturia inaequalis)*. Monmouth, Maine. M. T. Hilborn. Concentrate mist spray 4X applied to field plots with Liqui duster, at approximately 3 gals. per tree with one exception (mild sulfur). In 7 cases starred* the first named material was applied in pre-bloom sprays only, the second named one being used in all subsequent applications. Velsicol 73 not worth further trial. Fe Vancide greatly increased green color of foliage.

	Amts./100 g.	DC	PS	OP
Mn Vancide	1.5 lbs.	1	1	1
½ Mn + ½ Fe Vancide	¾ + ¾ lb.	2	2	2
Phygon + sulfur, then Mn vancide*	¼ + 4 lbs.	3	3	3
Manzate	2 lbs.	4	12	9
Mild sulfur (1½ g. per tree	8 lbs.	5	13	10
Velsicol 73	2 lbs.	6	16	16
Mild sulfur (3 g. per tree)	8 lbs.	7	7	5
Phygon, then Crag 341*	½ lb. 1 qt.	5	9	4
Lime sulf. + p.e.p. then mild sulfur*	s4½	9	11	11
Crag 341	1.5 qts.	10	10	7
Captan	2 lbs.	11	8	12
Sulfur + Phygon,* ferbam + sulfur	4¼ ¾-4	12	6	6
Coromere, then* SDD + ferric sulf.	½ 1 qt. + 1 lb.	13	5	14
Sulfur + Phygon,*	4¼	14	15	13
Sulfur + Mn. van.	4¾			
Fe Vancide	1.5 lb.	15	4	8
Velsicol 90%* ferbam	2 oz. ¾ lb.	16	14	15

*First mentioned fungicide applied pre-bloom only. Second material applied from then on.

Apple (Jonathan, Northern Spy, Red Delicious, McIntosh)

Scab *(Venturia inaequalis)*. Grand Rapids, Michigan. Walter Toenjes. In a field test with high pressure air blast equipment, sprays beginning with early pre-pink were applied at 4-10 day intervals throughout infection period. "Good control of scab was obtained in 1953 with all materials listed and is attributed to short intervals between applications during critical periods and to thorough coverage. No fruit or foliage damage occurred. Materials used showed no incompatibility with Parathion, DDT, Aramite, or lead arsenate. Crag 341 handled nicely, gave better foliage coverage, brighter and livelier appearance, and in addition seemed to give lower mite population and rosy aphid population."

	Amt./100 gal.		
Captan	2 lbs.	5 appls.	+ 4 of Ferbam starting with second cover
Coromere	½ lb.	5 "	+ 4 of Ferbam starting with second cover
Ferbam	1½	9 "	terminating with the 5th cover application on Red Delicious Northern Spy
Crag 341	1 qt.	8 "	terminating with the 4th cover application on Delicious only

Apple (Red Delicious)

Scab *(Venturia inaequalis)*. Hood River, Oregon. J. R. Kienholz. Six single tree replicates were sprayed with hand gun power sprayer in the pink and calyx, followed by grower application. Spring weather cold and damp. No nitrogen effect showing on trees until July 1. Phygon XL was irritating to operator. Previously, Phygon and Captan had been used without tree or fruit injury, but not under past season's conditions.

	Amt./100 gal.	DC	PS	OP
Ferbam	1½	3	1	1
Manzate	1½	1	1	1
Crag 341	1 qt.	3	1	1
Crag 5400	2	1	1	1
Crag 341 + Puratized	1 pt.-½ pt.	1	1	
Kolo-100	3½	1	3 (frt. rus.)	
Phygon XL	¾	1	3 " "	
Captan	2	3	2 leaf cast	

Apples (Starr)

Scab *(Venturia inaequalis)*. Bridgeville, Delaware. J. W. Heuberger and W. R. Comegys. In an evaluation of certain antibiotics and fungicides for the control of *Scab*, *Fire Blight* (Erwinia amylovora), and Frog Eye (Physalospora obtusa), the following materials were tested. Eight applications were made beginning with early pre-pink, and continuing through the 3rd cover spray. It will be noted that the antibiotics were less effective than the fungicides.

No.	Material	Conc. (lbs./gals.)	Fire Blight (Index) 1953	Fire Blight (Index) 1952	Frog-Eye (Index) 1953	Frog-Eye (Index) 1952	Scab (%)	Op
* 1	Untreated	——	1.25	3.1	2.25	6.2	21	4
* 2	Dithane Z-78	2-100	1.00	1.5	0.75	1.7	1	1
3	ditto	2-100	0.50		0.25		0	
4	ditto	1-100	1.25		1.00		2	
* 5	Parzate	2-100	1.50	0.7	0.00	1.4	1	1
* 6	Manzate	1½-100	0.75	1.3	0.25	2.5	1	1
7	Fermate	2-100	1.00		0.25		1	2
8	406	2-100	0.25		0.25		0	1
9	406 + Z-78	1-1-100	0.25		0.25		0	1
10	Mag. 70 + Z-78	4-1-100	1.00		0.75		1	1
*11	Thiolutin	30ppm	0.00	1.7	1.50	5.6	5	3
12	Thiolutin + Mag. 70 (4 lbs.)	30-4800ppm	1.00		2.25		4	3
13	Thiolutin + Z-78 (1 lb.)	30-1200ppm	0.00	2.4	1.25		9	3
*14	Terramycin	120ppm	0.25		1.00	5.5	20	3
*15	Streptomycin sulfate	30ppm	0.75	1.4	2.00	6.1	14	3
16	ditto	15ppm	0.50		2.50		18	3
L.S.D. at 5% P				1.6	1.17	1.5	8	
L.S.D. at 1% P				2.2	1.55	2.0	11	

*Applied to same trees as in 1952.

Apple (Rome)

Scab, Sooty blotch *(Gloeodes pomigena)*, and **Fruit rot**. In another test at Bridgeville, Delaware, by J. W. Heuberger, 13 applications were made ending with the 8th cover spray. "A conspicuous purple flecking of the foliage was produced by Zineb due to its incompatibility with lead arsenate in the petal fall and 1st cover applications, where no lime was used. This injury occurred only on variety Rome. Zineb sprayed trees showed some yellowing of foliage while Orthocide did not." The following materials are given in order of over-all preference.

	Schedule and Amt./100 gal. (5 gal. per tree/appl.)	DC	PS	OP
Parzate	(4#-Pre-Pink-1st C. (3#-2nd C-4th C. (2#-5th C-8th C.	1	2	1
Dithane Z-78	Same as Parzate	1	2	1
Mag. 70 sulfur followed by Parzate	Pre-pink & pink 8# at 4, 3 and 2#	1	2	2
Mag. 70 sulfur followed by Dithane Z-78	As above			
Mag. 70 sulfur followed by Bordeaux	As above 2-6-100 in covers	2	2	2
Captan 406	Same as Parzate	3	1	3
Unsprayed	——	4	1	4

Apple (Delicious)

Scab *(Venturia inaequalis)*. Ames, Iowa. W. F. Buchholtz and H. L. Lantz. Seven applications were made with high pressure sprayer at cluster bud, calyx, and 7 cover sprays. "Crag 341 and Orthocide 50W were not the equal of lime sulfur-wettable sulfur, and Puratized-wettable sulfur, in control of scab on foliage."

	% Control June 30—Sept. 9		PS	OP
Lime sulfur[1]—lime sulfur[2]—wettable sulfur[3]	95	96	3	1
LS[1]—WS[2]WS[2]	97	98	3	1
Puratized[1]—Pur.[7]—Ws[3]	96	95	2	2
"One-Pak"[1 2 3]	94	96	2	2
Crag 341[1 2 3]	58	75	1	3
Orthocide 50W[1 2 3]	88	65	1	3

Apple (Blaxtayman)

Scab *(Venturia inaequalis)*. Newark, Delaware. J. W. Heuberger. In a large scale comparison of certain fungicides used in combination with Mag. 70 Sulfur from pre-pink through 7th cover with hydraulic sprayer, the following materials were rated according to per cent scab on 250 fruits from each of 4 trees.

	Schedule & lbs./100 gals.	Scab %	DC	PS	OP
(1)	406 + Dithane Z-78	(Pre-p.-1st C 1-1-100 (2nd-4th C—¾-¾-100 (5th-7th C—½-½-100	10	2	1	1
(2)	Mag 70 Sulfur + 406, then 406	(Pre-p.-1st C—8,7,5-100 (2nd-4th C —1½-100 (5th-7th C —1-100	4	1	2	2
(3)	Mag. 70 + Z-78, then Z-78	(Pre-p.-1st C— 8,75 (then as in #2	11	2	2	2
(4)	Mag. 70 followed by 406	As in #2	7	1	3	3
(5)	Mag. 70 followed by Z-78	As in #2	18	2	3	3
(6)	Mag. 70 followed by Ferbam	As in #2	7	1	3	4
(7)	Untreated	Bordeaux 2nd-7th C	52	3	1	5
		L.S.D. at 5%	9			
		L.S.D. at 1%	12			

Apple (McIntosh)

Scab and rust *(Venturia inaequalis, Gymnosporangium juniperi Virginanae)*. Red Hook, New York. D. H. Palmiter. The following sprays were compared and rated in an orchard where high pressure sprayer was used.

	Amt./100g.	DC Scab Leaf-Fruit		Rust		PS	OP
Captan	2#	1	4	4	1	1	
Coromerc-Captan	¼-¾	1	3	7	2	2	
Coromerc-Fermate	¼-¾	1	6	2	5	3	
Tag 331-Crag 341	¼-1½ pt.	1	1	9	6	4	
Coromerc-Crag 341	¼-1½ pt.	1	1	7	7	4	
Fermate	1½	6	7	1	4	5	
Phygon-Fermate	¼-¾	1	8	3	8	6	
Coromerc	½	1	1	7	10	7	
Penn Salt Ferbam	1½	7	10	1	3	5	
Mag. 70-Captan	4½	2	2	6	12	9	
Coromerc D14	¼-1½ pt.	3	9	5	9	10	
CM 218	6	4	5	8	11	11	
Magnetic 70 sulfur	7	5	11	8	14	12	
Colsul	10#	5	12	9	13	13	

Apple (Rome)

Scab *(Venturia inaequalis)*. Winchester, Virginia. A. B. Groves. The following materials were compared in orchard plots with conventional high pressure sprayer. Nine applications were made beginning with pre-pink. Of the sulfurs only, Colsul gave poorest control of scab. Of all materials, best control was secured with Crag 341 (Glyodin) and Mercury half and half. Poorest control was given by Dithane-containing materials.

	Amt./100 g.	DC Sub only	DC All fun's	OP
Col-Sul (Canada)	7½ lb. thru 1st cover	3	5	
Spike Spray (CM-218)	6 lb thru 1st cover	1	3	3
Magnetic 70	6 lb. thru 1st cover	2	4	
Captan 50-W	(2 lb. thru 1st cover (1lb. 2nd, 3rd, 4th covers		2	2
Crag 341 + Pura. Agr. Spray	(24 oz. thru 1st C ; 32 oz. alone (8 oz. in combination thru 1st C.		1	1
Dithane Z-78 + Pura. Apple Spray	(1 lb. in comb. ; 2 lb. in covers (4 oz. thru 1st cover only		7	
Dithane Z-78	2 lb.		6	

Apple

Scab *(Venturia inaequalis)*. Pennsylvania, Fred H. Lewis. The following materials were rated in an 8-year old orchard of Staymared sprayed with high pressure mist sprayer at 3X concentration.

Treatment	Total Scab Spots on Leaves of 200 Spurs	% Fruit Scab at Harvest	% Severe Fruit Russett
Captan	16	6.5	19.5
Captan-Coromerc—EPN	4	2.0	17.5
Captan-Mag. 70 sulfur-parathion	7	2.5	19.5
Crag 341-lead ars.	106	7.0	34.5
Crag 341-lead—high pressure, gun-sprayed	27	2.0	60
Crag 341-mercury—lead	16	0.5	42.5
Crag 341-mercury—EPN	40	3.0	34.0
Crag 341-mercury—parathion	9	1.5	46
Crag 341-Coromerc—EPN	27	1.0	47
Puratized Agr. spray—EPN	13	4.0	36
Coromerc—EPN	23	0.0	19
Sulfur-ferbam-lead ars	586	5.5	18.5
Sulfur-ferbam—EPN	304	4.0	16
Sulfur-ferbam-parathion	108	1.0	34
Sulfur-Coromerc mix plus parathion	39	3.0	46.5
Ferbam—EPN	495	7.0	25.5
Ferbam-carbon—EPN	1080	6.0	24.5
Ferbam-phygon—EPN	80	2.0	73
Dithane Z-78—EPN	222	10.5	23.5

Scab control was satisfactory with all treatments except Ferbam, Zineb, and Ferbam-sulfur, with Crag 341 somewhat questionable. Coromerc and Puratized Agr. spray gave equal effects on russet when used alone, but when combined at half strength with Crag 341, Coromerc caused the most russet. Crag 341 was safer when applied as 3X concentrate with a blower than when applied as dilute high-pressure spray. Captan gave the best finish and no russeting and was superior to sulfur-ferbam on Staymared, only because of dull color of the sulfur sprayed fruit. Yield records over two years indicate that higher costs for some organics are far more than offset by higher fruit yields above those obtained with sulfur-ferbam. The use of Sulfur, Phygon or Mercury at usual concentrations may be accompanied by low yields. The highest yields have been obtained with Crag 341 without Mercury.

Apple (Henry Clay)

Blotch *(Phyllosticta solitaria)*. Stillwater, Oklahoma. F. Benn Struble and L. S. Morrison. Four replicate single tree plots were sprayed 5 times with the following materials beginning with petal fall. All materials were safe to the trees. Conclusions were drawn from examination of 100 fruits from each replicate. "Fermate while doing a good job of disease control leaves objectionable residue. Sulforon sprayed fruits had as much blotch as fruits receiving no fungicide. No blotch on Fermate sprayed fruit. Orthocide gave 6% and Sulforon-Bordeaux 13% blotchy fruit."

	Amt./100 gal.	DC % fruit blotch	OP
Orthocide	2 lbs.	6	1
Sulforon	6 lbs. 1st appln.		
Bordeaux	2-4 lbs. 2nd & 3rd appln.	13	2
Sulforon	6 lbs.	*	3
Fermate	2 lbs.	0	4

*Same as check.

Apple (Golden Delicious)

Blotch *(Phyllosticta solitaria)*. Key Stone, Oklahoma. F. Ben Struble and L. S. Morrison. From 7-8 gallons of the following sprays were applied to 4 replicate single tree plots with hydraulic sprayer, beginning with petal fall, and lasting through July 20 (5 applications).

	Amt./100 gal.	DC	PS	OP
Sulforon	6 lb.	4	1	1
Orthocide 406	2 lb.	3	1	1
Fermate	2 lb.	2	2	2
Bordeaux	2-4-100			
Sulforon	6 lb.	1	3	3

"We need material which will control blotch as well as Bordeaux and not russet copper sensitive varieties such as Golden Delicious."

Apple (Jonathan)

Brook's spot *(Mycosphaerella pomi)*. Newark, Delaware. W. R. Comygae. On a series of 7, single tree plots, sprayed from pre-pink through 7th cover with hydraulic outfit, the following materials were evaluated.

	Schedule and Amt. 100 gal. (12)g./tree	Spot (1%)	PS	OP
(1)	Captan (406) (Pre-p.-1st C. 2 lb. (2nd-4th C. 1½ lb. (5th-7th C. 1 lb.	1	1	1
(2)	Captan + Dithane Z-78 Same as #1	1	1	1
(3)	Captan and Z-78, alternating (Pre-p - P (P - 1st C. (2nd-4th C. (5th-7th C.	2	1	1
(4)	Dithane Z-78 Same as #1	6	1	2
(5)	Mag. 70 Sulfur followed by Ferbam (Pre-p-1st C. 8 lb. (2nd-4th C. 1½ lb. (5th-7th C. 1 lb.	0	2	3
(6)	Untreated	36	1	4
		L.S.D. at 5%—11		
		" " 1%—15		

Apple (Yellow Newtown)

Bulls eye rot *(Neofabraea malicorticis & N. perennans)*. Hood River, Oregon. J. R. Kienholz. Early and late applications of Zerlate sprays were made

(Turn to Page 125)

LISTENING *Post*

Gypsy Moth Defoliation at Peak '53-'54

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Dorward is connected with the Division of Insect Detection and Identification, Agricultural Research Administration, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Washington. His observations are based on latest reports from collaborators in the U.S.D.A.'s pest surveys throughout the United States.

By Kelvin Dorward

Cereal and Forage Insects

ALTHOUGH there were no major insect developments on cereal and forage crops during January, a grain mite (*Penthaleus major*) caused widespread concern on small grains in Texas. A survey early in the month revealed heavy infestations and damage in the south central and north central areas. These infestations were expected to continue to cause damage through February if warmer weather occurred. Greenbug populations were on the increase in the central area of Oklahoma with many fields having from 2 to 8 bugs per linear foot. This insect could also be found in most grain fields in eastern South Carolina; however, little damage was noted. Texas, on the contrary, reported popuations only in Moore and Randall Counties, and these were very light.

Aside from these current conditions, results of adult spittlebug survey in Illinois during the fall of 1953 are of special interest. The survey showed that, in general, the spittlebug population has decreased in this State, but the main area of infestations, eastern Illinois, remains about the same as in the fall of 1952. The potential, however, was lower in the fall of 1953 than in the fall of 1952.

Forest Insects

Gypsy Moth Defoliation — 1953: Gypsy moth populations had declined to an extremely low level by the summer of 1950 in the Northeast States and defoliation of forest growth by this insect that year was only 5,400 acres. In succeeding years the winters in New England were mild and conditions otherwise were very favorable for rapid increase in populations. As a result of these unusual conditions more than 1,487,000 acres were defoliated in the summer of 1953. The previous high peak in population abundance occurred in the summer of 1945 when nearly 821,500 acres were defoliated throughout the infested area. As would be expected, there was far greater mortality of trees in the summer of 1953 than in any year since the gypsy moth first became established in the United States. On the basis of observations made in the fall of 1953 it is anticipated that defoliation in the summer of 1954 will be at least equal to and perhaps greater than that which occurred in 1953. The only hope for reduction in defoliation this coming season is the possibility of heavy mortality of the eggs during the winter months.

Truck Crop Insects

Salt-marsh caterpillars were reported to be on the increase in San Particio and Refugio Counties, Texas, early in the month. The insects were attacking vegetables and weeds, and judging from the nature of the infestation, it is very possible that control measures will be necessary in early or mid-spring. Serious damage to flax and young cotton occurred in this area in the spring of 1952. A survey in the potato psyllid overwintering areas of southern Texas and southern New Mexico during the fall of 1953 showed populations to be lower than at the same time in any other year since 1946. This may have been due to the hot summer, which prevented summer populations from increasing and moving to the overwintering area, and to the mild fall which had not forced the psyllids to complete their movement into the overwintering area at the time the survey was made.

Studies of Hornworm Moth Flight Habits: During the 1953 season 13 "black light" electric light traps were operated cooperatively by Federal and State entomologists in 8 states from Florida to Connecticut to obtain information on the seasonal occurrence and flight habits of the moths of hornworms that attack tobacco. The records show a very good positive correlation between latitude and the date of first occurrence of tobacco hornworms moths, but not of tomato hornworm moths. The trends as indicated by the moth captures were in general quite similiar in both 1952 and 1953, although moths of both species were captured in considerably larger numbers in 1952 as compared with 1953 at nearly all locations. These studies have failed to furnish any evidence that there may be a general directional movement of hornworm moths. There is evidence of moving populations, but the origin of the moths in any given locality is still a matter for speculation.

Insects Affecting Man and Animals

1953 *Screw-worm Activity*: The screw-worm survey conducted in 1953 by the Division of Insects Affecting Man and Animals has been

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summarized and it is reported that in the southwestern area, scattered cases were found in the southern half of Oklahoma and Louisiana in late June but there were indications of reductions in cases over the panhandle country of Texas and Oklahoma due to extreme drought and high temperatures. The western half of Kansas was reported free of cases but nearly all of Texas, Oklahoma, southeastern third of Kansas, the southern half of Arkansas and most of Louisiana indicated infestations of some intensity. Northern Louisiana and southern Arkansas reported that cases were more numerous during the summer of 1953 than for several years. Cases were very light in West Texas, Oklahoma and Kansas.

Infestations in the southeastern area appeared to be about normal. Mississippi reported rather heavy infestations in some of the lower delta counties. Alabama, Georgia and South Carolina reported scattered cases, while Florida had very light infestations in Okaloosa and Walton Counties with heaviest infestations in the area from Perry in Taylor County to Lake City in Columbia County.

Although not included in the above survey, reports of screw-worm cases were received from California, Iowa, Nebraska and South Dakota during the 1953 season.

Seed Treatment Tests for Bunt Control

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by collaborators of the Plant Disease Survey Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, Beltsville, Md.

By Paul R. Miller

C. S. Holton and John Y. Woo report results of two cooperative seed-treatment tests for bunt (*Tilletia* sp.) control with chemical fungicides made at Pullman, Washington, in 1952, by the U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering and the Washington Agricultural Experiment Stations. One of these tests was on Triumph winter wheat, seeded in October 1951, and the other was on Red Bobs spring wheat, seeded in April, 1952. In July, 1952, the percentages of smut were obtained by counting the smutted heads and the total heads in each row. In rows with no smut, head counts were not made. All rows had full and approximately equal stands of plants. The results are presented in Table 1 for winter wheat and spring wheat, respectively.

The fungicides were applied at the indicated rates (Table 1) as dusts, slurries, or liquids. Samples of 125 grams of Triump wheat and 250 cc of Red Bobs wheat were used for each treatment. After applying the fungicides, the seed was thoroughly

Table 1. Relative effectiveness of fungicidal materials in the control of bunt in Triumph winter wheat and Red Bobs spring wheat, grown from bunt-inoculated seed, treated as shown, and planted in triplicated rod-rows at Pullman, Washington, 1951-52.

Triumph winter wheat					
Seed Treatment					Percent
No.	Material	Form	Oz/bu	Sticker used?	bunt
1.	Untreated check	—	—	—	49
2.	Ceresan M	Slurry	½	No	0
3.	Ceresan M	Slurry	½	Yes	0
4.	Agrox	Slurry	½	No	0
5.	Agrox	Slurry	½	Yes	0.3
6.	Anticarie	Slurry	½	No	0
7.	Anticarie	Dust	½	No	0
8.	Copper carbonate	Slurry	3	No	1
9.	Copper carbonate	Slurry	3	Yes	0
10.	Untreated check	—	—	—	50
11.	Panogen 1.4% Hg	Liquid	¾	No	0.3
12.	Panogen 1.7% Hg	Liquid	¾	No	0
13.	Panogen 2.0% Hg	Liquid	¾	No	0
14.	Plant Fungi Control	Slurry	½	No	9
15.	Plant Fungi Control	Slurry	½	Yes	21
16.	Hexachlorobenzene 60%	Dust	½	No	0
17.	Hexachlorobenzene 24%	Dust	½	No	0
18.	B.H.C. 50% + H.C.B. 25%	Dust	1	No	0
19.	Phygon pellets	Slurry	½	No	4.6
20.	Panogen 1.5%	Liquid	¾	No	0
21.	Mergamma	Slurry	2	No	0
22.	Mergamma	Slurry	2	Yes	0
23.	M.E.M.A.	Liquid	½	No	0
24.	Orthocide 406	Slurry	½	No	40
25.	Actidione (10 p.p.m.)	Dust	—	No	30
26.	Untreated check	—	—	—	43

Red Bobs spring wheat					
Seed Treatment					Percent
No.	Material	Form	Oz/bu	Percent sticker	bunt
1.	Untreated check	—	—	—	67
2.	Agrox	Dust	½	0	0.1
3.	Agrox	Slurry	½	0	0.6
4.	Mycon	Slurry	½	0	0
5.	Agrox	Slurry	½	0.25	0
6.	Agrox	Slurry	½	0.75	0
7.	Agrox	Slurry	½	1.00	0
8.	Agrox	Slurry	½	1.50	0
9.	Setrete	Liquid	½	0	0
10.	Untreated check	—	—	—	66
11.	Mergamma	Dust	1¾	0	0
12.	Mergamma	Slurry	1¾	0	0
13.	Tritisan	Dust	2	0	0
14.	Brassicol	Dust	2	0	0
15.	Ceresan M	Dust	½	0	1.2
16.	Ceresan M	Slurry	½	0	0
17.	Mercusol	Liquid	½	0	1.4
18.	Merculine	Liquid	½	0	0
19.	M.E.M.A.	Liquid	½	0	0.1
20.	Panogen	Liquid	¾	0	0
21.	Anticarie	Dust	½	0	0
22.	Anticarie	Slurry	½	0	0

agitated in closed glass containers until coverage of the seed by the fungicide was assured. It was then left covered for 24 hours. A sticking agent (Methocel) was used in some samples to determine its effectiveness in holding the dust on the seed. Each lot of treated seed was planted in replications of three rows.

In both tests, most of the materials were highly effective in controlling bunt, in comparison with the standard commercial treatment, Ceresan M. Among the effective new treatments are the mercury compounds Agrox, Panogen, Mergamma, Setrete, M.E.M.A., Mercusol, and Merculine. The non-mercurials included copper carbonate, Orthocide, Actidione, hexachlorobenzene (Anticarie), and pentachlornitrobenzene (Plant Fungi Control, Tritisan, and Brassicol). Copper carbonate (50%), used as a slurry, was difficult to apply but nevertheless effective. The sticking agent, Methocel, was not effective in holding the dust on the seed after the water had evaporated from the slurry-treated seed.

Poor control was given by Orthocide 406, Actidione, and Plant Fungi Control. This last compound, which is 20% pentachlornitrobenzene, gave good control in previous years, thus indicating that the supply used this year had deteriorated with age.

Hexachlorobenzene Action on Fungi

W. N. Siang of the Washington Agricultural Experiment Station and C. S. Holton of the U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering state that certain benzenederivatives have been tested recently as possible bunticides for the prevention of bunt of wheat. Hexachlorobenzene (HCB), in particular, has shown promising results among a number of polychlorobenbenes tested. In experiments in France, effective control of bunt (*Tilletia caries*) was obtained by the application of HCB in various forms of seed treatment, viz., immersion, sprinkling, and dusting. Dry treatment of seed at a dosage of 8 gms. of HCB to 100 kg. seed (0.16 oz./bu.) gave complete control of bunt. The inoculum had been applied at the rate of 300 mg. per kg. seed (a spore dosage of 1 to 3300). In the United States, similar results were obtained in both spring and winter wheats when either "Anticarie" or HCB (24% and 60%) were applied as dusts at one-half oz. per bushel. Anticarie is a commercial product containing 20% to 40% HCB as manufactured by H. P. Rossiger & Co., New York, and by French Dyestuffs Ltd., Hamilton, Ontario, Canada). Slurry application of Anticarie was also effective on spring wheat. One-half ounce of Anticarie (40% HCB) per bushel is equal to a dosage of 20 gms of pure HCB to 100 kg seed, a figure comparable to that reported by French workers.

In the winter wheat areas of the Pacific Northwest, control of dwarf bunt is difficult primarily because of soil infestation, which renders ordinary seed treatment ineffective. To be effective against this smut, therefore, a fungicide should possess certain properties that make it capable of protecting the susceptible seedling from infection by soilborne inoculum. The possibility that HCB is such a material is indicated in the results from soil-application trials with four fungicides, in which it was found that Anticarie gave significant control of dwarf bunt in three out of four locations, whereas the other three materials tried (Ceresan M, Agrox, and Spergon) were ineffective. Since all of the these materials are toxic to wheat bunt spores, these results suggest that HCB possesses bunticidal properties entirely different from the other materials used. An attempt was made to determine the mode of action of HCB.

It was suggested that the prophylactic action of Anticarie on dwarf bunt spores might be due to the sublimation of HCB in the soil. Some preliminary trials, therefore, were made to determine whether the vapor of HCB inhibits germination of the bunt spores under laboratory conditions. Since germination of dwarf bunt spores cannot be satisfactorily induced, spores of *Tilletia caries* race 9 and *T. foetida* race 8 were used in these experiments.

Different amounts of HCB (0.1, 1, 5, and 10 mg) were placed in separate small glass vials, each of which was at the center of a Petri dish containing 10 ml of 2 percent water agar. (H. P. Rossiger & Co., New York, supplied Pure HCB for this investigation). The solid material of HCB was thus kept from physical contact with the agar medium. Spores of *Tilletia caries* and *T. foetida* were sown on separate agar plates and incubated at 20°C. The Petri dishes were sealed with rubber seals to prevent escape of HCB vapor. Readings of spore germination were taken after seven to ten days. In the control plates 89.4 per cent of the spores germinated. In the plates treated with 0.1, 1, and 5 mg. of HCB, the percentages of germination were 32.5, 17.2, and 7.4, respectively. It was found that a minimum of 10 mg. of HCB was required to completely inhibit spore germination in a 10-cm Petri dish incubated at 20°C. for seven days. Repeated trials gave similar results, supporting the evidence recently reported from France that HCB vapor actively inhibits germination of bunt spores.

Some experiments were conducted to learn if the temperature of HCB exerts any influence on spore germination. Petri dishes, each containing 10 mg. of HCB, were incubated at 10°, 15°, and 20° C for seven to ten days. The percentages of spore germination were 4.8, 1.3, and 0 at 10°, 15°, and 20° C respectively. There was 80 to 90 per cent spore germination in the control plates. In further experiments, wide-mouth quart jars containing 150 mg of HCB were held at 60°C for 24 hours with a view to hastening sublimation. Small Petri dishes, previously sown with spores of either *T. caries* or *T. foetida*, were placed in these Mason jars and incubated at 10°, 15°, and 20° C for germination studies. At the end of seven to ten days, no germination was observed in any of the plates incubated at these temperatures, while all of the control plates showed more than 80 per cent germination. These results seem to

(*Continued on Page 141*)

...and the corn came tumblin' down

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INDUSTRY *News*

Geigy Appoints LeVasseur

Geigy Agricultural Chemicals, New York, announced late in January the appointment of Mr. Saul LeVasseur to branch manager of the Northeast Territory. Mr. LeVasseur, former state sales manager of Maine, succeeds Mr. G. D. Baerman who resigned recently.

Mr. LeVasseur was manager of the insecticide department of Aroostook Potato Growers in Presque Isle, Maine, from 1942 to 1950 before joining Geigy as sales manager in Maine three years ago.

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Connolly Joins Pfizer

Patrick J. Connolly, with the insecticide division of S. B. Penick & Co., New York, for the past six years, has just joined the agricultural sales division of Chas. Pfizer & Co., New York.

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Horsfall Gets Leave

A sabbatical leave, to be devoted to research and teaching at the University of California, at Berkeley, Calif., has been granted Dr. James G. Horsfall, director of the Connecticut Agricultural Experiment Station, New Haven, Conn.

Dr. Horsfall will prepare research data for publication, revise his text "Fungicides and their Action," and lecture on fungicides. Neely Turner, assistant director, temporarily replaces Dr. Horsfall at the station, during his leave in California.

Gleissner Joins Diamond, Polite Named Ag. Chem. Sales Mgr.

L. J. POLITE

BRUCE D. GLEISSNER

Two new managerial appointments in Diamond Alkali Company's recently established Chlorinated Products Division were announced late in January by vice president C. E. Lyon, division manager.

Bruce D. Gleissner has been named assistant general manager of the division. He will be concerned chiefly with furthering the commercial development of agricultural chemicals. L. J. Polite, Jr. has been promoted to the post of agricultural chemicals sales manager. Both Gleissner and Polite have already assumed their new duties at the general offices in Cleveland.

In his new position, Dr. Gleissner will be responsible for sales, new product development, technical applications and all phases of agricultural chemicals activities except production. Formerly manager of the insecticide department of American Cyanamid Company, he was a faculty member of Pennsylvania State University, State College, Pa., from 1940 to 1944.

Mr. Polite takes over his new assignment after nearly two years as agricultural chemicals assistant sales manager headquartered at the company's eastern agricultural chemicals plant in Newark, N. J. Active in the chlorinated solvents sales field since 1942, he joined Diamond following his graduation from Williams College, Williamstown, Mass. A World War II veteran, he saw service with the U. S. Navy in the Pacific Area.

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Neb. Agr. Fertilizer Plant

A new fertilizer plant to manufacture a granular fertilizer will be constructed in the near future in Junction City, Kansas, by the Nebraska Agricultural Chemical Co. Building plans include a one-story structure, with an anticipated employment of 25 persons.

NCC Meets In Atlanta

How to increase efficiency and reduce costs of cotton production were to be discussed at the National Cotton Council's sixteenth annual meeting in Atlanta, Ga., February 1, and 2. C. L. Welch, director of the Council's production and marketing division, indicated the Council will intensify its efforts to develop improved programs for insect control. The Oscar Johnston Cotton Foundation, representing the cotton industry, has appropriated money to supplement other funds to finance the cooperative Pink Bollworm Research project, called into action last year by a serious pink bollworm threat.

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Shell Films Pest Control

A 12-minute motion picture of Howard Waters, farmer near Danville, Io., and his experience in controlling corn pests, has been produced recently by Shell Chemical Corp., New York. The film was previewed in Washington by a group of agricultural specialists in government and the chemical industry and is now being shown to audiences throughout the Corn Belt. The film shows the effectiveness of insecticides applied to soil before planting,—comparing pictures of healthy plants in treated areas with shrivelled, weak plants in an untreated test row.

•

Processing Crop Growers Meet

The annual raw products conference on the production of vegetable crops for processing was scheduled to be held February 9th, and 10th at Jordan Hall, New York State Experiment Station, Geneva, N Y. A joint program arranged by the Agricultural Committee of the New York State Canners and Freezers association, Inc. in cooperation with the research and extension staffs at Geneva and Cornell University, includes special sessions on vegetable and fruit problems.

A review of insecticide residue questions on crops grown for processing was to be presented by J.E. Dewey and A. C. Davis. A discussion of weed control problems by R. D. Sweet, M. Miller and L. Curtis was also on the program.

D. J. Lathwell was to present a paper on soil testing as a basis for making fertilizer recommendations; while a panel discussion on bulk handling of raw products was to include F. Wyatt, J. H. Levin, J. Robinson, O. Bruno, R. Cash and P. Lynch. Airblast spraying of vegetables with concentrate and dilute spraying machines was scheduled to be outlined by W. T. Schroeder and W. Gunkel.

Some of the other reports on the program deal with the following subjects: costs in purchasing, corn insects and diseases, pea insect and disease control studies, cabbage and broccoli pests, control of fruit diseases, and grape culture research.

•

Alabama Pest Control Conf.

The eighth annual Alabama workshop for plant inspectors is scheduled for February 23rd, to be followed by the fifth annual short course for aerial applicators and pesticide manufacturers and distributors on February 24th and 25th at the Agricultural Experiment Station of the Alabama Polytechnic Institute, Auburn, Ala.

Under the chairmanship of J. A. Lyle, Alabama Polytechnic Institute, the workshop program includes a panel discussion on problems involved in sweetpotato production; discussions of the problems of plant inspectors, nutrient deficiency studies, and finally a tour of horticulture greenhouses.

The program of the Plant Pest Control Conference annual short course includes a report by E. V. Smith, on "The Role of Plant Pest Control in our Agricultural Program;" a paper on the "Proposed Research on Pink Bollworm of Cotton" by F. S. Arant; and a review on the "Effect of Cotton Insecticides on Beneficial Insects" by R. R. Robertson.

Also included in the program are the following: "Geographic Distribution of the White-Fringed Beetle" by B. P. Livingston; "Economics Involved in Control of Pests of Agricultural Crops" by F. S. Arant and L. M. Ware; "Present Status of Pest Control on Peaches" by C. C. Carlton; "Effect of Agricultural Chemicals on Wildlife Populations" by A. O. Haugen; "Weed Control in Fish Ponds" by J. M. Lawrence; "Control of Pests on Ornamentals" by R. L. Self and B. W. Arthur; "Problems of Forest Insect Control" by R. J. Kowal; "Present Status and Control of Mimosa and Oak Wilts, and Little-Leaf of Pine" by G. H. Hepting.

Panel discussion on "Problems in Aerial Application," G. Wilson, moderator; panel discussion on "Products That Show Promise in Pest Control," G. R. Williams, moderator; panel discussion on "Evaluation of Pesticides for Farm Use," W. A. Ruffin, moderator.

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Miller Bill and Canning

How the revised Miller bill concerning pesticides will affect the canning industry was explained to canners late last month at a conference of the National Canners Association in Atlantic City, N.J. J. Harry Covington, office of counsel, NCA, called on the canners to "reduce pesticide residues in the course of food processing" wherever possible.

He added that should pesticide residues remain in canned food, however, the products will be judged, not by the new Miller bill, recently introduced in Congress, but by the old Food, Drug and Cosmetic Act which permits regulation of added chemicals in foods and, indirectly, the use of pesticides.

In the course of revising the Miller bill, Rep. Miller changed the bill to cover only "raw agricultural commodities." No provision of the amendment applies to processed foods. Hence, Covington stated, although tolerances would be established under the new act on the raw materials used by canners, processed foods would, in effect, be in the same position as they are today.

"In the absence of a tolerance for pesticide residues in processed foods established under Section 406 of the Act, any charge that a residue level in any processed food made it adulterated would have to fall under Section 402 (a) (1)," he continued. "This would require a showing that the poisonous or deleterious pesticide in the food may render it injurious to health."

•

Attapulgus Minerals & Chemicals Corp., Phila., has bought American Cyanamid Co.'s one-half interest in the Porocel Corp., making the latter a wholly-owned Attapulgus subsidiary, it was announced late in January.

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Hold 4th Annual Louisiana Insect Control Conference

Arrangements committee: C. R. Blair, W. L. Roark, and K. L. Cockerham, general chairman.

THE Fourth Annual Louisiana Insect Control Conference convened in the Bentley Hotel, Alexandria, January 14 and 15, with 100 members of agricultural extension, research and industry in attendance. Kirby L. Cockerham, extension entomologist of Louisiana, general chairman, opened the meeting with a short statement of the purpose of the conference, pointing out the importance of keeping abreast of changing conditions—reductions in cotton acreage, invasion of the state by the pink bollworm, insect resistance to insecticides, new materials and new practices.

Key-note speaker of the conference was Dr. I. L. Forbes, assistant director of the Louisiana Agricultural Experiment Station. He observed that there is too big a gap between research and farm use of research findings, and that the gap must be closed for effective results from research. Dr. Forbes called for more funds for research to supply the additional information needed.

The first panel discussion of the conference was on the availability and price trends of insecticides, led by T. H. Tennent of Ethyl Corp. Participants agreed that industry has sufficient capacity to produce all insecticides required, and that no shortage is anticipated. Prices were said to be too low, and slight increases can be expected; but increased cost of the formulated materials to the farmer will be very slight.

Sugar cane and rice insect control were discussed by A. L. Dugas, entomologist, Louisiana Experiment Station, and Robert W. Helm, entomologist of the U.S.D.A., Crowley. Dugas reported on the severe damage caused by the cane borer in 1953, and predicted the heaviest infestation in 1954 in recent years, if cold weather does not reduce the overwintering population. He also discussed soil insect control and stated that two tons increase per acre has been obtained in experimental work with soil treatment. Helm reported on research work with rice insects, but had little to report on control, since the work has not been running long enough for results to have been obtained. He named the rice stink bug, the sugar cane borer, the rice water weevil and the fall army worm as being the most serious pests.

(Left photo) panel discussion on insecticides and price trends: L. F. Bewick, Velsicol Corp., T. H. Tennent, Ethyl Corp.; and Leonard Edwards, Hercules Powder Co.

(Right photo): L. C. Murphree, Coahoma Chemical Co., C. B. Haddon, N. E. Branch Experiment Station; J. I. Seego, Commercial Chem. Co.; R. C. Gaines, U. S. Bureau of Entomology and Plant Quarantine; and I. W. Carson, Louisiana Agricultural Extension Service.

One of the most interesting panel discussions of the conference was on the relation between the insecticide representative and the county agent, participated in by Fred Huffman, Mathieson Chemical Co., and Irwin Schroeder, Hayes-Sammones Chem. Co., from industry, and W. L. Roark and G. A. Luno, county agents. All members of this panel agreed that the commercial representative should contact the county agent, get state and county recommendations and sell only recommended products.

A panel discussion on soil pests and control was led by Dr. L. D. Newsom, Louisiana Agricultural Experiment Station, and participated in by A. E. Weil, Dow Chemical Co., Dr. C. C. Compton and Dr. M. J. Sloan, Shell Chemical Corp., and Dr. W. J. Martin, Louisiana Agricultural Experiment Station. Weil, Sloan and Martin discussed methods of soil treatment, primarily for nematodes, and showed slides of crop injury and results of soil treatments, while Dr. Compton described and discussed various soil insects as well as giving treatments for them, stressing the

(*Turn to Page* 141)

Soviet Ups Ag. Chem. Prod.

The Soviet Union has announced a forced-draft program for increasing agricultural chemical production during the next ten years. Main objective, according to the government newspaper *Izvestia*, is to boost mineral fertilizer output nearly six-fold. This would mean production of at least 16,500,000 metric tons by 1959 and nearly 30,000,000 metric tons by 1964.

Coincidentally, Russia's chemical industry was ordered to manufacture cheaper, more effective poisons to combat insects, rodents and plant diseases, and to develop production of organic and mineral additives for cattle and poultry feed.

Output of organic poisons has lagged badly during the postwar period, *Izvestia* declared. It demanded a 100 percent increase in DDT and benzene hexachloride production by the end of 1956.

"To date," *Izvestia* continued, "we have given little attention to the extremely important task of organizing production and use of new organic, weed-killing herbicides. We have depended on older, less effective inorganic herbicides which must be used in large quantities.

"Organic herbicides permit extremely efficient selective 'chemical weeding' of fields. However, not only has large-scale production of these herbicides been inadequately developed, but the assortment is still insufficient." *Izvestia* said that use of iron salts, urea, calcium, sodium, cobalt salts, zinc and phosphates in cattle and poultry feed rations has been small in the USSR despite their proved value.

In ordering increased fertilizer production, the Russian decree said special attention should be given to compound and mixed fertilizers; to micro-fertilizers having small quantities of manganese, zinc, boron, copper and magnesium; and to bacterial and liquid fertilizers.

It is reported that production of mixed fertilizers was halted during World War II and despite agriculture's demand for them, output has not been fully restored. Ammonium phosphate and a triple fertilizer containing nitrogen, phosphorus and potassium were particularly affected by the wartime shutdown. However, production of these fertilizers, together with potassium sulphate and sodium nitrate, and such concentrated fertilizers as double superphosphate and dicalcium phosphate dihydrate, will be greatly increased under the new ten-year program.

The Russian chemical industry has been called on to make use of industrial wastes in expanding fertilizer production. It pointed to the need for obtaining phosphate slag from phosphorous iron used in making steel and and for making fertilizer from carbon dioxide gas put out by factory furnaces.

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Safety Executives Meet

Twenty-three executive committee members discussed activities of the Fertilizer Section, National Safety Council, at a special meeting in Chicago Jan. 13.

Curtis A. Cox, chairman of the industrial safety committee, reported on a meeting of the group Dec. 14. Other reports were made by committee heads, with brief talks by officials and staff representatives of NSC included on the agenda. Ned Dearborn, president of NSC, Charles F. Alexander, manager of the industrial department of NSC and Stewart Washburn, staff representative of the national organization, addressed the meeting.

Included in the discussions was consideration of the North Carolina safety drive and proposed inauguration of similar safety drives in other states.

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Drought Cuts Fertilizer Use

Texas farmers used smaller amounts of fertilizer in 1953 due to drought, Dr. R. D. Lewis, Texas Agricultural Experiment Station reported to a recent meeting of representatives of the fertilizer industry at College Station, Texas. According to members of a panel discussion, nitrogen and its compounds will probably continue in short supply during the coming season. However, both potash and superphosphate should be plentiful.

New Mathieson Plant

Commercial production began recently in a new $1,500,000 unit for the manufacture of chemical fertilizer of high analysis, pelletized type, according to a recent announcement by J. R. Beatty, Houston operations manager for Mathieson Chemical Corporation. The new plant in Pasadena, Calif., is expected to increase production at Mathieson's Pasadena operations by 25 per cent. Modifications of the existing sulfuric acid plant and fertilizer plant at Pasadena, costing slightly more than $400,000 have also been completed in recent weeks. The expansion is said to provide the Houston area with the largest chemical fertilizer plant in the southwest and one of the largest in the nation.

While the new fertilizer unit will make the same products as made in previously existing facilities, Mr. Beatty said certain process improvements have been included in the new unit.

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Bill Chace Returns

William E. Chace, who is known to many fertilizer industry leaders because of his work with the National Fertilizer Association, has returned to the chemical field after serving as Washington representative of Group Attitudes Corp.

In his new position, Chace is assistant public relations director of the Manufacturing Chemists' Association. He is working with Cleveland Lane, formerly of Pennsalt, who recently was appointed assistant to William C. Foster, president of MCA.

Chace served for seven years as director of information of NFA. During World War II he was assigned as White House and Department of State correspondent for the Office of War Information and for three years was attached to the Office of War Information, British Supply Council, in Washington, for which he was decorated by the British Government.

Appointment of Chace is part of an expanded public relations program of MCA, which represents 90 per cent of the United States chemical industry.

ERNEST HART

Sees Expanded Market

Wider and more effective use of chemicals will enable farmers to increase yields on present croplands equivalent to an additional 100 million acres, Ernest Hart, Food Machinery and Chemicals Corp., N. Y., told members of the National Council of Farmer Co-operatives in an address before their recent annual meeting at the Edgewater Beach Hotel, Chicago, January 11. He estimated that if farmers would apply effectively results of new research chemicals, "they can cut by at least a third the 16 billion dollars loss American agriculture now suffers annually from insects and other pests." The majority of farmers are not making the most effective use of chemicals, he added.

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N. Cent. ESA Meets Mar. 25-26

An address by Dr. Herbert H. Ross, president of the Entomological Society of America, will highlight a meeting of the North Central Branch, ESA, March 25 and 26. Dr. Ross, who will address the group at the Hotel Paxton, Omaha, Neb., will discuss progress of the parent organization in consolidating the ESA and the American Association of Economic Entomologists. The groups were merged late in 1952.

Reorganization of BEPQ, and the widespread implications it has to the field of economic entomology will be outlined by Clarence H. Hoffman of the Bureau. Concluding the first morning's talks will be one by Dr. Harlow B. Mills, chief of the Illinois Natural History Survey Division, who will give his views on the relationship and integration of fields within entomology.

Dr. George C. Decker, head of the section of economic entomology of the Illinois Survey, and program chairman, will lead off the second meeting with a report on methods of making "guestimates" on insect losses. Other talks will include one by Dr. Clyde W. Kearns, University of Illinois, on the concept and practical value of synergism; a discussion of the uses of viruses, bacteria and fungi in commercial insect control by Dr. B. A. Porter, chief of the section of fruit insect investigations, Entomology Research Branch and an interpretation of the evaluation of true versus apparent insect resistance to chemicals by Dr. C. C. Roan, of USDA.

Informal sectional meetings will be concerned with insects affecting fruit, vegetable and canning crops, field crops, stored products, shade trees, ornamentals and man and animals, according to Dr. Harold Gunderson, program chairman.

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Utah Coop. Names Two

The appointment of Jack E. Horton and Willard R. Hasbrook to the staff of the Utah Cooperative Association (a Farmers Union affiliate) of Salt Lake City has been announced by general manager W. B. Robins.

Mr. Horton, formerly assistant manager of the Horsley Seed Company, Brigham City, Utah, has been named general superintendent of the Kelly-Western Seed Division. In this capacity, he will have general supervision of the Division's purchases and sales of seeds, chemicals and fertilizers.

Mr. Hasbrook, formerly manager of radio station KFXM, San Bernardino, California, has been named sales manager of "Pax" Brand Products, and UCA advertising manager. In this capacity he will develop regional and national distribution of Pax Crabgrass and Soil Pest Control, a pre-emergent herbicide, owned and manufactured by UCA's Kelly-Western Seed Division. The product has formerly been distributed principally in the Mountain States and California.

CLARENCE E. ELSAS

Elsas Pres. Bag Assn.

The Textile Bag Manufacturers Association, concluding their annual winter meeting in New Orleans, elected Clarence E. Elsas of Atlanta, Georgia, to head the group for the coming year. Elsas, who is President of the Fulton Bag and Cotton Mills, is serving his second term as leader of the association which is composed of the nation's largest manufacturers of textile bags. Members of the group from all sections of the country attended the meeting and heard speakers from the cotton and burlap industries outline business prospects for the ensuing year.

Other officers elected include: vice-president: Richard K. Peek, Percy Kent Bag Co., Kansas City; and, members of the executive committee: A. H. Ames, San Francisco; M. J. Anderson, Jr., Hutchinson, Kansas; J. J. Eshleman, Lancaster, Pennsylvania; M. M. Feld, Houston, Texas; James Dowling, Valdosta, Georgia; H. V. Howes, St. Louis, Missouri; F. H. Ludington, New York; G. D. Morgan, Richmond, Virginia; T. J. Semmes, Memphis, Tennessee; L. O. Sprosty, Cleveland, Ohio, and Joseph Werthan, Memphis, Tennessee.

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Wyandotte Appoints Healy

Lawrence J. Healy, Jr. was recently appointed a technical service representative of the Michigan Alkali Division, Wyandotte Chemicals Corporation, Wyandotte, Michigan. Mr. Healy joined Wyandotte in 1948.

ALFRED T. LOEFFLER

FMC Appoints Loeffler V.P.

Alfred T. Loeffler has been appointed vice president — Chemical Divisions of Food Machinery and Chemical Corporation, New York, Ernest Hart, executive vice president of the corporation announced recently. Mr. Loeffler joined Food Machinery and Chemical Corporation as assistant vice president in August 1953.

He formerly served with Monsanto Chemical Company in various capacities including general branch manager in New York and director of development of the Organic Chemicals Division at St. Louis. In 1951, on leave from Monsanto, he became chief, chemical branch Office of Price Stabilization in Washington.

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AgChem. Serv. Changes Name

United Fertilizer Co. is the new name for the Agricultural Chemicals Service Co., effective January 1, 1954.

The change was made to be more descriptive of its functions: distribution of commercial fertilizers. It also ties in with advertising of the United Chemical Co. which supplies commercial insecticides, fungicides, and kindred products to farmers in the five Pacific States.

Personnel and officers remain the same as for the other two companies, Heckathorn & Co. and United Chemical Co., Richmond, Calif. E. S. Heckathorn is president, I. R. Burden, vice-president, and L. R. Moretti, secretary-treasurer.

Heckathorn & Co. is the manufacturing unit for the two United companies, and also does packaging, blending, and compounding for many firms throughout the nation.

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Davison Fla. Plant to Operate

Sales of triple superphosphate by The Davison Chemical Corp., Baltimore, will be handled by the company's heavy chemicals department, of which William Caspari, Jr., is general sales manager. Other products coming under this department are sulfuric acid, run of pile and granulated 20 per cent normal superphosphates and phosphate rock. Production of both run of pile and granulated superphosphates will be started shortly at a new plant in Bartow, Fla., with a total rated capacity of 200,000 tons per year.

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Research Survey in Progress

The Chemical-Biological Coordination Center is reviewing the publication habits and related research practices of American biologists. In connection with this study the Center is seeking sources of unpublished data from research in all areas of biology where the effects of chemicals on biological systems are involved.

The first returns from a nationally distributed one-page questionnaire have shown a most encouraging degree of interest. The Center is grateful for the co-operation it is getting, and urges that all biologists who receive a questionnaire during the next few months complete and return it as soon as possible.

The survey is intended to improve the efficiency of the CBCC as a research tool whose primary function is to coordinate and speed up the dissemination of facts and ideas from original research in the biological sciences. The results of the study will be analyzed, and distributed to all those who are interested.

Inquiries regarding the CBCC may be addressed to: Dr. G. Congdon Wood, Chemical-Biological Coordination Center, 2101 Constitution Ave., N.W., Washington 25, D. C.

Southern Safety Group to Meet

PROGRESS of the fertilizer section of the National Safety Council will be discussed at a meeting of the Southern Safety Conference next month in Louisville, Ky.

The fertilizer section of the conference will hold a two-day session March 8 and 9. Discussing progress of the Fertilizer Section will be Vernon S. Gornto, of Smith-Douglass Co., Norfolk, Va., who is general chairman of the section. Other talks to be featured at the conference will consider safety precautions for conveying systems and hazards in the phosphate mining industry.

Speaking on the first subject will be R. S. Diserens, safety director for Phillips Chemical Co., Bartlesville, Okla. B. J. Phillips, safety director for Coronet Phosphate division of Smith-Douglass, Plant City, Fla., will air the prevalent hazards in mining phosphates.

All three talks will be featured in the first afternoon meeting, following attendance by delegates Monday morning at general sessions of the Southern Safety Conference. The representatives will attend the general sessions again Tuesday morning, and will adjourn to a sectional meeting in the afternoon, at which a panel discussion on case histories will be featured, according to Mike C. Ellison, chairman of the Southern States Fertilizer Section.

Participants on the panel will include W. A. Stone, superintendent, Wilson & Toomer Fertilizer Co., Jacksonville, Fla.; Roy W. White, safety supervisor, Lion Oil Co., El Dorado, Ark.; Frank Kruck, safety inspector, Virginia-Carolina Chemical Corp., Richmond, Va. and O. A. Dixon, production supervisor, International Minerals & Chemical Corp., East Point, Ga.

Another talk scheduled for the afternoon session will be given by W. C. Creel, safety director of the North Carolina Department of Labor, Raleigh, N. C., whose topic will be "Safety Facts and Figures."

McVickar Addresses Ohio Assn.

A featured report at the 39th annual meeting of the Ohio Vegetable and Potato Growers Association in Toledo, January 18th, was an address by M. H. McVickar, National Fertilizer Association.

Mr. McVickar pointed out that to get the most out of fertilizer, the user should: (1) use the product providing a balanced ration of plant foods for the crop being grown, (2) use the correct amount, and (3) put the fertilizer where the growing plant can make full use of it. "Leaf feeding, the application of plant nutrients to the leaves of growing plants in the form of sprays, can be used to advantage in many instances," he reminded his listeners, "however, it cannot replace soil application of fertilizer; neither does soil application offer the advantages of leaf feeding under certain circumstances.

"Leaf feeding offers a particularly promising method of applying trace element plant foods in those parts of the country where minor element deficiencies are common." Mr. McVickar observed that although commercial vegetable growers have been very progressive in adopting good farm management practices, the highly competitive nature of their business requires them to reduce their production costs even further, if they are to continue to prosper.

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CSC to Offer Paraffins

J. A. Wood, president of Commercial Solvents Corp., New York, announced late in January that the company will build large scale facilities at Sterlington, La., for the production of nitroparaffins, a new family of petrochemicals not previously available to industry in volume.

This family of compounds is important for its potential as a raw material for producing other chemicals. The agricultural industry is one of the fields in which the nitroparaffins and derivatives have found successful application. Full scale production of the new plant is scheduled for the last quarter of 1955.

Nitroparaffins have been under study by the Commercial Solvents Corporation since 1935.

1955 officers of Northwest Vegetable Insect Conference: D. H. Brannon, Pullman, Wis. secretary; H. H. Crowell, Corvallis, Ore., chairman; and A. J. Walz, Parma, Idaho, co-chairman.

Pacific NW Vegetable Insect Conf. Held

By Charles Starker

ENTOMOLOGISTS from seven states and provinces gathered in Portland, Ore. at the Imperial Hotel for their 13th annual conference on January 18-19-20. Co-chairman Dr. H. H. Crowell, Oregon State College, opened the industry section meeting with a summary of research on pests of crucifers, carrots and corn. He reported soil treatments against onion maggots using chlordane and other insecticides were ineffective in one area in Oregon. Losses in stand ranked from 50 to 100% in many fields.

Oregon investigators used "Systox" and other systemics in tests on hops for spider mite control. Experimental work using DDT against the beet leafhopper on sugar beets in one locality in Utah raised yields 30%. Malathion dust holds promise for control of aphis on pole beans in Oregon.

Soil treatments against tuber flea beetles on potatoes were found more satisfactory than foliage treatments. In one section of Washington the green peach aphid on potatoes has been found to be resistant to all of the commonly used insecticides. The resistance is more pronounced as the season progresses. Late breaking virus on potatoes was a serious problem in central Oregon last season. The virus is carried to potatoes from clover, and possibly several weed hosts, by the 6-spotted leaf hopper.

No new recommendations are contemplated for control of pea insects. Systox was applied to peas, which when sampled 7 days after treatment, showed very low residues.

The Strawberry Crown Moth is still one of the most vexing problems facing workers in small fruit crops. Washington workers reported better control of spittle bugs with aldrin and heptachlor, than with chlordane; applications were made early in the season. Infestations of Narcissus bulb fly were prevented by use of a dip of heptachlor, aldrin, or chlordane in work done at Sumner, Washington.

Soil Insecticides

DDT applied in the soil still kills wireworms at the end of six to nine seasons. Research workers are not quite so impressed with seed treatment for wireworm control as they were a few years ago.

Various formulations of granular and pelleted insecticides were discussed. One benefit claimed for this formulation is elimination of dust.

Officers elected for the 1955 meeting were Chairman, Dr. H. H. Crowell, Oregon State College, Corvallis, Ore.; co-chairman, A. J. Walz, University of Idaho, Parma Branch Exp. Sta., Parma, Idaho; secretary, David H. Brannon, Washington State College, Pullman, Wash. Dates for the 1955 meeting will be January 17, 18, 19 at the Imperial Hotel, Portland, Oregon.

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CHEMICALS

Photos Courtesy of Illinois Natural History Survey

Top, left to right: J. H. Bigger, Illinois Natural History Survey; W. C. Slavens, Champaign, Ill.; D. Stewart, Princeville, Ill. and G. C. Engel, Chatham, Ill.

Bottom, left to right: F. W. Slife, Urbana, Ill.; W. Cox, Franklin, Ill.; L. Gilbert, Arcola, Ill.; and V. Anderson, Newark, Ill.

Top, left to right: K. P. Buchholtz, Univ. of Wisconsin, G. Johnson; E. Davies, Gardner, Ill. and H. B. Petty, Urbana, Ill.

Bottom, left to right: Stevenson Moore III, Urbana; L. Hedden, Perkin, Ill.; R. Ueding, Vincennes, Ind.; and J. Kemp, Belvidere, Ill.

SPRAY OPERATORS HOLD 6TH TRAINING SESSION

NEW agricultural chemicals, liquid fertilizers, pest control problems, and herbicidal storage problems were among the reports featured at the sixth Custom Spray Operators' Training School held January 21-22 at the Illini Union, University of Illinois, Urbana. More than 550 attended the training school sessions and convention of the Agricultural Spraying Association and Illinois Aerial Applicators' Association, which held meetings on January 20th, also at the Illini Union.

J. Garland of Dixon, Ill., was re-elected president of the Agricultural Spraying Assoc.; while R. G. Ueding, Lawrenceville Illinois Municipal Airport, Vincennes, Ind., was re-elected president of the Illinois Aerial Applicators' Association. H. B. Petty, State Natural History Survey, Urbana, Ill., was in charge of program arrangements.

In a discussion of "Chemical Weed Control in Crops," R. J. Smith, Jr., Agronomy Dept., Univ. of Illinois, Urbana, reviewed the various cultural and chemical methods of weed control, as well as pre- and post-emergence studies. He indicated that chloro-IPC controls grasses better than DNBP, while DNBP controls broadleaf weeds better. In 2,4-D applications to corn, he reported several types of injury: brittleness, malformation, onion leaf. It is to be stressed that the discussions at the Urbana meeting were aimed at the local (mid-western) area, and as a result of field tests under local conditions.

F. W. Slife, Univ. of Illinois, Urbana, discussed a series of new herbicides, particularly, maleic hydrazide (MH), naphthyl phthalamic acid (NP), CMU and "Dalapon." He reported that MH was good for the eradication of wild garlic and onion in non-cropped areas; that NP was particularly good as a pre- and post-emergence killer in cucurbits, although not quite as good as either dinitro or CIPC; and that CMU shows particular promise as a soil sterilant.

C. W. Kearns, University of Illinois, outlined the new insecticidal chemicals, which he classed generally as the chlorinated hydrocarbons, organic phosphates and urethanes.

According to A. J. Ohlrogge, Purdue Univ., Lafayette, Ind., in a discussion of the formulations and uses of liquid fertilizers, "the future of liquid fertilizers is not bright unless the phosphate problem is solved (i.e. the cost). Bulk handling of dry materials and custom mixing without curing for immediate application is extremely competitive price wise." Dr. Ohlrogge outlined the various

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CALIFORNIA AND SOUTHERN STATES HOLD '54 WEED CONFERENCES

Weed Control Measures Reviewed in Sacramento

OVERALL and specific weed control measures, use of wetting agents, spray drift and damage, research and new herbicides were among the subjects featured at the sixth annual California Weed Conference, held January 27-28 in Sacramento, California. Various applications of "Dalapon" to California weed problems were outlined by A. W. Swezey, Dow Chemical Co., Seal Beach, Calif., in his report on the promising new systemic grass killer. He indicated that the major advantage of this compound appears to be its ability to translocate in grass foliage.

Soil-sterilant properties of CMU were described by M. C. Swingle of Cupertino, Calif., representing the E. I. duPont deNemours Co. He indicated that this herbicide should be applied under conditions where rainfall is expected to be adequate to carry the material into the root zone, where it is most effective. He emphasized that the efficiency of CMU is largely dependent upon such factors as amount of rainfall, dosage applied, type of weeds and character of the soil.

"A major cause of ineffective weed control is the failure of herbicides to penetrate leaves and to become absorbed by living cells" conference members were reminded by H. B. Currier, Univ. of California, Davis, Calif., in his report on "Wetting Agents and Other Additives." He indicated also, that on the basis of present knowledge, effective surfactants for grasses seem to be those soluble in oils, fairly soluble in water, having fair (but not outstanding) wetting power, and with slight or no toxicity.

A general outline of the research program in the California Agricultural Experiment Station was reviewed by Dr. S. Freeborn, who pointed out that because of carelessness or arrogant use of herbicides in areas of diversified agriculture, considerable damage has occurred; however, he reminded his listeners that "we have a tool in chemical herbicides, which if properly used can make the difference between success and failure in many of our important crops."

E. C. Bruch, Calif. Department of Agriculture, Sacramento, reported that crop seed contaminated with weed seeds is responsible for half of the cost of recleaning crop seed in California. He said that much of this expense is caused by the planting of unclean or partially cleaned seed; and then outlined a program designed to reduce this cost. In a panel discussion of spray drift and damage, A. B. Lemmon, also of the Calif. Department of Agriculture, discussed the toxicological considerations of hemlock, water hemlock, plants containing nitrates and ergot.

P. B. Kaufman, University of California, reported that in comparative tests with 2,4-D, 2,4,5-T and MCP, it was found that rice was most susceptible to 2,4-D, and least susceptible to 2,4,5-T. Temperature and stage of growth are factors which affect susceptibility. L. L. Davis, Uni-

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DuPont, Dow Announce New Herbicides

NEW herbicides to be offered commercially in the near future by E. I. du Pont de Nemours & Co., Wilmington ("Karmex") and by Dow Chemical Co., Midland Mich. ("Silvex") were discussed in reports featured at the seventh annual Southern Weed Conference, held January 11-13 at the Hotel Peabody, Memphis, Tenn. Dr. W. B. Ennis, Jr., Mississippi Agricultural Experiment Station, State College, Miss., retiring president of the conference, expressed to the membership in his opening address that not enough attention has been given to weeds in crops other than cotton; that weeds in the grasslands of the South are also serious; and that certain vegetable crops and horticultural crops are not produced profitably in some Southern states largely because of weed problems and plant diseases.

Dr. W. C. Shaw, USDA, Beltsville, Md. newly elected president, reported that the agricultural chemical outlook indicates that improvements in herbicides will come from the four basic chemical groups now being used widely; and that the greatest current need is for close-knit cooperation between research and farmer.

Other officers named for the 1955 conference include: Glenn C. Klingman, North Carolina State College of Agriculture and Engineering, vice president; and E. G. Rodgers, University of Florida, secretary-treasurer. It was announced that the next year's meeting will be held at St. Petersburg, Florida.

A team of duPont scientists reported on laboratory and field work leading to the selection of a commercial compound for weed control in cotton. A formulation of the du Pont family of substituted urea herbicides, now trademarked as "Karmex" will be available in limited quantities in a few cotton growing areas this year. According to the duPont spokesmen, results of tests indicate that "Karmex" has a good margin of safety, so far as cotton plants are concerned, with yields from areas treated with the compound equal to, or better than yields from areas where common weed control practices were used. "Karmex" will be marketed as a liquid suspension with each gallon containing

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Davison Plant in Operation

Production of granulated homogeneous fertilizer, utilizing modern handling and processing facilities, has been started at the new plant of the Davison Chemical Corporation, Baltimore, according to a recent announcement by J. L. Gayle, local plant manager.

In addition to processing and storage equipment, the plant has a modern office building and welfare and shop facilities. Cost of the plant was approximately $1,000,000 and it will employ from sixty to eighty men, according to season, the annual payroll being more than $200,000.

Davison built the plant to replace fertilizer manufacturing facilities at its old site. Expanded and improved facilities were desired so that Davison could manufacture granulated homogeneous fertilizer, a product in the form of small granules having the advantage of being dust-free, resisting caking in storage, flowing freely through distributing machinery, and having important nutrient advantages when applied to the soil.

In addition to Mr. Gayle, the staff of the new plant include Major W. Hancock, superintendent, W. H. Martin, sales supervisor and Miss Garnett Anshutz, office manager.

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Naco Names Smith as Fla. Mgr.

William R. Thurston, president of Naco Fertilizer Company, Joplin, Mo., announced recently the appointment of W. C. Smith as manager of Naco's Florida operation, Mr. Smith, who succeeds O. C. Minton will be responsible for sales, production and distribution at Naco's Fort Pierce and Jacksonville plants. He will maintain offices in Fort Pierce.

Mr. Smith was formerly employed by Armour Fertilizer Works, starting with them in 1935. Since leaving Armour in June, 1953 he has been attached to the combined general offices of Naco Fertilizer Company and Thurston Chemical Company in Joplin. Operations of both Naco Fertilizer Company and Thurston Chemical Company are under the direction of William R. Thurston, who serves as president of both companies. Thurston Chemical Company is a division of W. R. Grace & Co., international industrial and trading concern, and Naco is a wholly owned subsidiary.

Naco operates plants in Fort Pierce and Jacksonville, Florida; Charleston and Spartanburg, South Carolina; Wilmington, North Carolina; and Findlay, Ohio. Thurston Chemical Company has plants in Joplin and Trenton, Missouri; Tulsa, Oklahoma; and Lawrence, Kansas.

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ACS Elects DuPont Man

Charles J. Krister, manager of the agricultural product development section of E. I. du Pont de Nemours Co., was recently elected 1954 chairman of American Chemical Society's Division of Industrial and Engineering Chemistry. He succeeds J. H. Rushton, director of the chemical engineering department at the Illinois Institute of Technology.

Opposes Chlorine Plan

Outright sale of a government-owned chlorine plant, rather than its lease to private industry, was called for last month by Diamond Alkali Co. In a statement to the U. S. Defense Department and the Military Affairs Committee of Congress, Diamond urged the sale of the government's chlorine facilities at Muscle Shoals, Ala.

The plant was constructed early in the Korean emergency to make sure the country had enough of the chemical for defense requirements.

Diamond contends that sale of the plant, instead of its lease, as the government proposes, would be better for production purposes, would provide greater incentive to the purchasing company and would benefit taxpayers to a greater extent.

Canadian Agricultural Chem. Assn. Formed

A FULL and varied program, featuring important speakers in every phase of agriculture, has been planned by the Canadian Agricultural Chemicals Association for its first general meeting and conference, Feb. 19.

Prominent among the distinguished speakers scheduled by the association to address members of Canada's pesticide industry is Paul Mayfield, president of the National Agricultural Chemicals Association, who will discuss NAC activities.

CACA plans to make the meeting and conference an annual event. This year's meeting will be held at the Royal York Hotel, Toronto. Guest speaker at the banquet, capping a full day of speeches and discussions, will be the Hon. J. G. Gardiner, minister of agriculture.

Theme for the conference is "More Effective Pest Control through Cooperation." Main portion of the morning session, after opening remarks by the program chairman and newly-elected president, will be devoted to a panel discussion on the major insect control problems in Canada, by members of Science Service, Canada Department of Agric.

Panel members include Dr. J. J. Fettes, assistant chief Forest Biology division; Dr. H. E. Gray, head, stored product insect unit; Dr. A. P. Arnason, assistant head, field crop insect unit; G. G. Dunstan, officer in charge, fruit insect laboratory, Vineland, Ont. and D. G. Peterson, assistant entomologist. Moderator of the panel discussion will be W. A. Ross, head of fruit insect unit, Division of Entomology.

Five talks on various facets of agriculture, including the address by Mayfield, are set for the afternoon.

Problems involving weed control and seed disinfecting in Canada will be aired by H. E. Wood, department of agriculture, Winnipeg, and Dr. A. W. A. Henry, University of Alberta, respectively. Wallace Murdoch, president of Ford Tractor Co., will discuss "Merchandising to the Farmer." A talk on "Publicity as an Effective Weapon in Pest Control" will close the afternoon meeting.

Any number of officers of a member company are eligible to attend the meeting, according to J. H. D. Ross, CACA president.

Roderick Heads New Div.

The establishment of a new Phosphate Chemicals Division by International Minerals & Chemical Corporation, Chicago, was announced recently by Louis Ware, president. Howard F. Roderick, recently elected a vice president, will head the division.

The new division will provide for the continued growth of International's phosphate chemicals operations, which now include a plant near Bartow, Florida, that recently went into operation, and plants at Wales, Tennessee and Tupelo, Mississippi. Heretofore the operation of these plants has been a part of the corporation's Phosphate Division.

Under the new production and sales program International will have two phosphate divisions. The Phosphate Minerals Division, headed by George W. Moyers, vice president who has been in charge of the Phosphate Division, will be repsonsible for the mining and refining of phosphate ores in Florida and Tennessee. The new Phosphate Chemicals Division, will produce phosphate and sell chemicals.

Mr. Roderick comes to International from Wyandotte Chemicals Corporation, where he has been director of sales for its Michigan Alkali Division since 1950.

The establishment of the Phosphate Chemicals Division as separate from the corporation's other phosphate activities was timed with the completion of International's new Bonnie plant near Bartow. This plant, which represents an investment of approximately $15,000,000, produces defluorinated phosphate for use as an animal feed supplement as its primary product. It also produces multiple superphosphate having the highest available phosphorous analysis for use as plant food. As a by-product it extracts uranium compounds from the phosphate ore, for the Atomic Energy Commission.

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Diamond Forms New Division

Diamond Alkali Co., Cleveland, announced recently the establishment of a Chlorinated Products Division. The former Plastics and Agricultural Chemicals Division has been abolished. C. E. Lyon, vice president and works manager of the Houston plant, has been named general manager of the new division.

Products and plant facilities encompassed by the Chlorinated Products Division are: agricultural chemicals, Houston and Newark, N. J.; Chlorowax, carbon tetrachloride and hydrochlorio acid, Painsville, O.; perchlorethylene, hydrochloric acid and vinyl monomer, Houston; and methyl chloride, methylene chloride, chloroform and hydrochloric acid, Belle, W. Va.

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Spencer Promotes Two

Spencer Chemical Co., Kansas City, Mo., announced recently the promotion of Dallas Cantwell and Gordon Crowe.

Gordon Crowe, formerly senior technical service representative, has been promoted to the new post of assistant manager of the technical service section. This realignment of the company's service organization was made in preparation for Spencer's expansion into polyethylene.

Dallas Cantwell, formerly agronomist, northeast district, has been promoted to the newly created position of assistant manager, agronomy section. In his new post, Mr. Cantwell will assist P. W. Gull, manager of the section, in research and demonstration work in agricultural chemicals, as well as fertilizer.

The new positions are one phase of the long-range agricultural chemicals program announced recently by Spencer Chem. Co.

Stauffer Advances Haschke

Theodore A. Haschke has been appointed director of sales of the newly-organized industrial chemical division of Stauffer Chemical Company, its subsidiaries and associated companies, to take care of the increased scope of Stauffer's activities in this field, it was announced recently by Hans Stauffer, executive vice-president.

Mr. Haschke started in the chemical business in 1919 and joined Stauffer seven years later. He was named sales manager of the eastern division in 1942, a post he held until this latest promotion.

The creation of the new division was prompted by the rapid expansion and growth of the company, according to Mr. Stauffer, and the necessity of a more intensive and efficient sales marketing program to take advantage of existing and new fields.

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New Tri-State Fertilizer Plant

Davidson-Kennedy Company, Atlanta, has been awarded the engineering contract for construction of the new Tri-State Company fertilizer plant in Henderson, Kentucky. Estimates of the cost are in excess of $130,000.00.

The new Tri-State plant will serve an area of approximately fifty miles of Henderson and formulas adopted will be designed for usage in this area. Present plans are for the manufacture of general types of fertilizer embodying nitrogen, phosphate and potash.

TRONABOR*

A NEW CONCENTRATED BORATE WEED KILLER

TRONABOR is a new concentrated borate weed killer containing not less than 13.7% Boron and 44% B_2O_3, combining the properties of a general-contact weed killer and soil sterilant. **TRONABOR** is most effective when applied dry but can also be used in solution as a spray. When you use **TRONABOR** the job is done! Most weed growth is destroyed for a year or longer. Under favorable conditions **TRONABOR** may give control up to three or four years. When applied before or during seasonal rainfall it is dissolved and permeates the soil to the root zone of the plants where it destroys and prevents re-growth until removed by normal leaching. **TRONABOR** is safe, easy to apply, non-corrosive and non-flammable. No other type of weed killer combines so many advantages.

HOW AND WHEN TO APPLY TRONABOR*

In dry form, TRONABOR is easily applied by hand-broadcasting. On larger areas one of several available types of fertilizer or lime-spreaders is recommended. It should be distributed evenly and in sufficient amount. It is better to over- than under-apply, since too little may give unsatisfactory results. Where practical, standing weed growth should be cut to a height of 4 to 6 inches to insure that the TRONABOR is spread evenly. On bare slopes raking in will prevent the material from washing away during heavy rains.

• • • • •

TRONABOR is best applied in the Fall, Winter or early Spring when rainfall carries it into the root area of the soil. TRONABOR must be dissolved to be effective. For annuals and shallow-rooted perennials apply when plants are young and tender. Deep-rooted perennials should be treated in Fall or Winter. Apply TRONABOR at the rate of 7½ to 11 pounds per 100 square feet, depending upon severity of conditions. The higher application should be used on steep slopes, where weed growth is thickly matted or well established, or where the soil is hard and impervious or very sandy or porous. Spot retreatment of some areas at about ½ the above dosages may be advisable later.

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Economical
Soil Sterilant

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Canada Thistle
Bindweed
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Whitetop (Hoary Cress)
Johnson Grass
Poison Ivy and Oak
St. Johnswort (Klamath Weed)
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Fert. Conf. at Univ. Md.

A fertilizer conference was held at the University of Maryland, College Park, Md., January 29th. Members of the university staff presented results of recent research work on fertilizers to fertilizer manufacturers who were in attendance. Among the addresses was one, "Future Developments in Fertilizers," by K. D. Jacob of the Water Conservation Research Branch, Section of Fertilizer and Agricultural Lime, U.S.-D.A.

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Another Fertilizer Record

The record for fertilizer consumption in the United States and Territories is still going up, but by smaller degrees, the preliminary report on fertilizer consumption for the year ended June 30, 1953 reveals. Issued by Walter Scholl, Hilda M. Wallace and Esther I. Fox, the report estimates that for this most recent fertilizer consumption year farmers consumed 23,143,000 tons of commercial fertilizers, an increase of 3.2 per cent, or 711 thousand tons over the 22,432,418 tons reported for the 1951-52 season.

Biggest jump in consumption last year came in the field of secondary and minor element materials, which were up 10.8 per cent to 870 thousand tons, the report shows. Consumption of commercial mixtures was estimated to be 15,508,000 tons, an increase of 2.8 per cent, while consumption of materials containing primary plant nutrients (N,P_2O_5, K_2O) for direct use increased 3.1 per cent to 6,765,000 tons.

Other figures in the preliminary report show that consumption made its biggest gains in the North Central and Pacific regions, where totals were up nine to 20 per cent, while it dropped from five to seven per cent in the New England and South Central states. Although the South Atlantic region still consumes the highest tonnage of fertilizers, the East North Central region now is the largest consuming area, based on primary nutrients contained in the mixes.

Consumption of the primary plant nutrients amounted to 5,562,000 tons, a net increase of 359 thousand tons or 6.9 per cent more than the revised total of 5,203,003 tons consumed in 1951-52. Net increase for N was 13.7 per cent, for P_2O_5, 1.5 per cent and for K_2O, 8.3 per cent.

This preliminary report was received too late for complete inclusion in this issue. Full text will appear in March *Agricultural Chemicals*.

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Miller Offers New Bill

A new bill which provides a procedure for the establishment of tolerances by the USDA for new pesticidal chemicals, was introduced in the House January 11th by Rep. A. L. Miller of Nebraska. The new bill H. R. 7125, is to be substituted for H. R. 4277, introduced by Rep. Miller during the last session, and which died in committee.

Bill H. R. 7125 is the result of conferences held during the interval between the two congressional sessions, and participated in by representatives of industry, the Food and Drug administration, the House committee and Congressman Miller, to iron out the objections that had been raised against the original proposal. Mr. Miller indicated that all parties concerned have now agreed on the major issues in question.

Under the proposed bill, manufacturers (or their representatives) would file a petition with the secretary of the Department of Health, Education and Welfare, requesting a tolerance along with scientific data and reasons in support thereof, and would request the Secretary of Agriculture to certify to the Secretary of Health, Education and Welfare that the pesticidal chemical was useful for its intended purpose, and the requested tolerance was in line with the amount of residue likely to result when the material was used as proposed. Within 90 days after this petition was filed, a regulation establishing a tolerance would be made public. The Bill also provides for appeal after tolerances are established, and for committee analyses of petitions which are under question.

NAC Program Set

A group of leading authorities in the pesticide field is scheduled to address the spring meeting of the National Agricultural Chemicals Association, meeting in Houston, Texas, March 24-26. They will discuss problems in distribution, sale and use of pesticides which have arisen during the past few years. The meeting will be held in the Shamrock Hotel.

Among the speakers are John C. White, Texas State Department of Agriculture; Dr. R. D. Lewis, director of the Texas Agricultural Experiment Station; J. A. Walker, credit manager of Standard Oil Company of California and Dr. Stanley B. Freeborn, provost of the Davis, California station of the California College of Agriculture. In addition, Paul Mayfield, general manager of the Naval Stores Department, Hercules Powder Co., and president of N.A.C.A. will address the convention.

Dr. Lewis will review some of the background on research and development of agricultural chemicals in the Southwest. Mr. Walker is scheduled to discuss the credit situation as it pertains to the industry, while Dr. Freeborn will cite the value of pesticides and their contribution toward raising standards of living by improving the quality of our food supply.

Presiding at the sessions, along with Mr. Mayfield, will be W. W. Allen, of Dow Chemical Co. Features of the convention include a reception for members and guests the evening of March 24 and a golf tournament March 25, with a banquet or barbeque following.

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Ammonia Plant Planned

An anhydrous ammonia plant in Reserve, Kansas, is planned by the Brown County Fertilizer Co., a newly formed corporation. E. Reese of White Cloud, Neb. is president of the new firm.

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New Iowa Fertilizer Co.

A new nitrogen fertilizer company, Legreid Farm Service, was formed recently at Emery, Ia. The new concern will supply liquid nitrogen fertilizer to farmers in this area.

Anaconda Advances Logan

R. A. Jones, sales manager of the fertilizer department of Anaconda Copper Mining Co., Anaconda, Mont., announces the appointment of Everett E. Logan as assistant sales manager. Mr. Logan has been associated with the fertilizer sales department at Anaconda for the past six years. After graduating from the University of Montana, he obtained his Master's Degree from the University of Southern California at Los Angeles. At the conclusion of World War II Mr. Logan spent two years with the Occupational Forces in Germany. During the past six years Mr. Logan has been office manager of the fertilizer department, along with assisting in sales work.

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Fert. Safety Group Meets

A meeting of the executive committee of the fertilizer section of the National Safety Council, held January 13th, in Chicago, offered several reports on the progress of pending activities.

A. B. Pettit, Davison Chemical Corp., Baltimore, as chairman of the engineering committee advised that the data sheet on anhydrous ammonia had been compiled and would appear in the February issue of *National Safety News*. He also reported that data sheets on ammonia solutions and insecticides would be ready in the near future.

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Ark. Assn. Elects Melton

W. O. Melton of Trumann, Ark. was elected president of the Arkansas Anhydrous Ammonia Dealers Association at the 2nd annual meeting of the organization held in Little Rock, Jan. 25. W. L. Castleberry of Newport was elected vice president and G. E. Davis of Lepanto was named secretary-treasurer. Melton succeeds Donald D. Wood of Helena in the presidency.

•

Hyster Co. Appoints Dealer

Hyster Co., Portland, Ore., manufacturers of "Hyster" industrial trucks, and an extensive line of materials handling equipment, has appointed Bode-Finn Co., Cincinnati and Dayton, Ohio, as dealers. Ray J. Finn is president of Bode-Finn. The territory to be served by the new Hyster dealer includes all counties

RAY J. FINN

of southwestern Ohio, the counties of Franklin, Dearborn, Riplee, Ohio, and Switzerland in Indiana and the Kentucky counties of Boone, Campbell and Kenton.

•

Stauffer Moves N. Y. Office

Stauffer Chemical Co. announces the removal of its New York headquarters from 420 Lexington Avenue to 380 Madison Avenue, New York 17, N. Y., effective February 1st. The new telephone number is OXford 7-0600.

Agronomists-Industry Meet

Soil testing and factors affecting the time of application of fertilizer will highlight the annual joint meeting of midwestern agronomists and fertilizer industry representatives at the Palmer House in Chicago, February 19th. An attendance of more than 400 is expected at the meeting sponsored by the Middle West Soil Improvement Committee.

Among the guest speakers scheduled to address the meeting is P. T. Truitt, president of the American Plant Food Council, who will discuss "Fertilizer Production Facilities." Other reports scheduled in the program include an address by E. H. Tyner, University of Illinois, on "Principles Involved in Selecting Time for Application of Fertilizer;" and a report by H. E. Myers, Kansas State College "What Does the Future Offer for the Fertilizer Industry?"

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Revised 'Entoma' Available

The new tenth edition of *Entoma*, a 424 page directory of pest control materials, is just off the press. It contains an up-to-date data listing of insecticides, fungicides, herbicides, diluents, emulsifiers, adjuvants, and seed disinfectants. Copies are available at $2.00 from Entoma, University of Maryland, College Park, Md.

Award to United Co-operatives, Inc.

A completely redesigned line of packages for United Co-operatives, Inc., paid off last month when one of the containers won first prize for design in a national competition. The award, made for the one-gallon can of Unico Grain Fumigant, was made at the National Council of Farmer Cooperatives annual meeting in Chicago. The competition was among cooperative farm supply and marketing groups.

Featuring a lemon yellow background with Unico in reverse lettering on a black plate, the design also uses red lettering and a red seal. It is in harmony with the design of other agricultural chemicals manufactured by United, according to E. A. Georgi, manager of the Farm Chemical Division, at Alliance, O.

Family resemblance among various products was carried out in the redesigning, with certain chemical groups, such as insecticides, stock sprays, etc. given different color schemes to make identification easier.

AGRICULTURAL CHEMICALS

Gen. Chemical Appoints 3 VP's

General Chemical Division, Allied Chemical & Dye Corporation, New York announced recently the appointments of three new vice presidents to head major segments of its operations. This division of Allied Chemical is one of the country's primary producers of industrial, agricultural and scientific chemicals.

Vincent W. Suellau has been named vice president in charge of sales; I. H. Fooshee, vice president in charge of development; and Harry S. Bowen, vice president and auditor. Mr. Mark M. Biddison, president of the division, stated that in view of General Chemical's increasingly diverse operations the new posts have been created to broaden the Division's top management and provide for continued effective supervision and coordination of its activities.

One of the six major operating divisions of Allied Chemical & Dye Corporation, General Chemical produces more than one thousand products ranging from industrial acids and other heavy chemicals, to high purity laboratory reagents and agricultural insecticides, in plants located throughout the United States and Canada.

A member of the General Chemical sales organization for 33 years, Mr. Suellau had been director of sales since 1950. Prior to that, he was sales manager for heavy chemicals for six years. Mr. Fooshee joined General Chemical in 1947, serving successively as assistant to the president, director of operations, and director of development.

Mr. Bowen, with General Chemical since 1923, was made auditor in 1930 and assistant general manager in 1938. During the war, he served for a period as plant manager of West Virginia Ordinance Works, which General Chemical Defense Corporation operated for the government at Pt. Pleasant, West Virginia.

•

Ruskin New Chem. Const. VP

Mr. J. H. Ruskin was elected executive vice president of Chemical Construction Corporation, New York according to a recent announcement. Mr. G. I. Seybold and Mr. Martin de Simo were elected vice presidents, and Mr. Thomas P. Forbath was named assistant to the president.

J. H. RUSKIN

Mr. Ruskin joined the parent firm, American Cyanamid Company, as a member of the legal department in 1947 and later served as assistant secretary and assistant general manager of the Petrochemicals Division. Messrs. Seybold, de Simo and Forbath had held executive posts with Chemical Construction.

•

Harry B. Baylor Dies

Harry B. Baylor, retired president of International Minerals & Chemical Corporation, Chicago, Ill., died recently in Charles Town, W. Va. He was 68. Burial was at Atlanta, Ga.

Mr. Baylor began his business career with Armour Fertilizer Works in 1901. He joined International Minerals & Chemical Corporation, in 1913 to organize its bagged goods business. In 1917 he became sales manager of the southern division, in charge of the sales of bagged goods and bulk goods. In 1927 he was made vice president of the corporation in charge of both northern and southern fertilizer sales. In 1934 he became general manager of the corporation's fertilizer division, in charge of all functions, including sales, production and credits.

Since his retirement five years ago Mr. Baylor had resided at his Gap View Farm, near Charles Town. He is survived by his wife and daughter.

Defoliation Conf. in Memphis

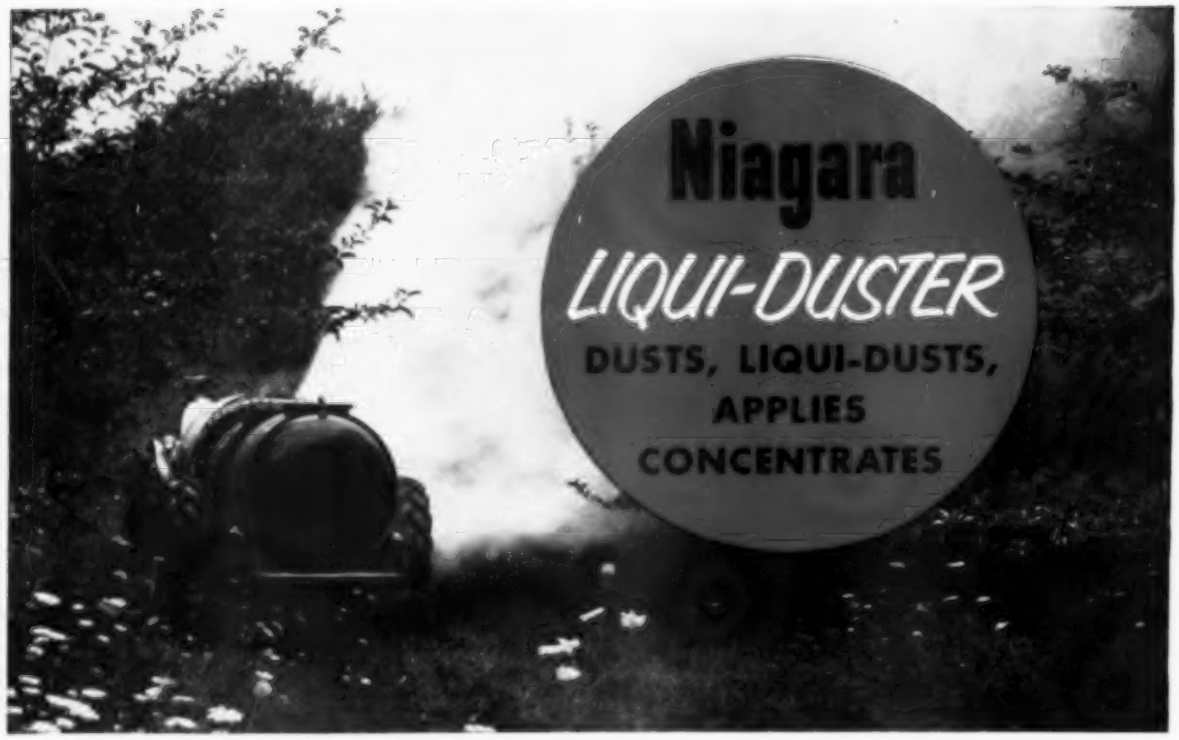
"Amino triazole has shown great promise in most areas of the Cotton Belt, as a 'second-growth inhibitor' as well as an effective defoliant", O. B. Wooten, Delta Branch Experiment Station, Stoneville, Miss., reported to members and guests attending the eighth annual Beltwide Defoliation Conference, held January 14-15 at the Hotel Peabody, Memphis.

H. Miller, USDA, Shafter, Calif. and R. S. Bone, Food Machinery Corp., Fayetteville, Ark. discussed a self-propelled spraying machine designed especially for irrigated cotton areas, where foliage is particularly rank and tangled. The general benefits of defoliation were reviewed by G. B. Crowe, and H. R. Carns, Delta Branch Experiment Sta., Stoneville, Miss.; and the relationship of defoliation to cotton market values was presented by E. E. Berkley, Anderson, Clayton and Co., Houston.

Defoliation as a means of insect control was discussed by F. C. Bishopp, coordinator of the Pink Bollworm Research Project in Brownsville, Tex.; and J. Ritchie Smith, National Council led a symposium which dealt with the "Evaluation of Defoliation Benefits." Participating in the symposium were: H. C. Miller, U. S. Cotton Field Sta., Shafter, Calif.; F. C. Elliott, Texas Agric. Ext. Serv., College Sta., Tex.; T. J. Johnston, Miss. Agri. Ext. Serv., Stoneville, Miss.; and W. A. Balk, Edisto Exp. Sta., Blackville, S. C.

Featured also at the meeting was a panel discussion on "Dessiccants versus Defoliants" including V. T. Walhood, USDA, Calif. Agr. Exp. Sta., Los Angeles; E. D. Cook, Blackland Exp. Sta., Temple, Tex.; D. L. Jones, Texas Exp. Sta., No. 8, Lubbock, Tex.; and J. M. Green, Oklahoma Agri. Exp. Sta., Stillwater, Okla.; "Advances in Applied Defoliation" were reported by I. W. Bales, Chipman Chemical Co., Boundbrook, N. J.

Dr. W. H. Tharp, Beltsville, Md., was conference chairman of this eighth annual session.



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The large dust discharge area plus a powerful air blast assures even distribution—no blotching on the outer areas of trees—complete coverage with less material.

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Maryland to Survey Insects

Dr. Ernest N. Cory, state entomologist, announced recently the transfer of Wallace C. Harding, Jr., Instructor, Department of Entomology, University of Maryland, to survey work on the economic insects of Maryland. He will get data on the abundance of important insect pests throughout the year in order to aid the extension and research entomologists to determine the immediate and long range needs in helping the citizens of the State to meet their insect problems. This survey work is in cooperation with the Economic Insect Survey Section, Plant Pest Control Branch, U. S. Department of Agriculture.

Mr. Harding has been engaged in the processing and distribution of spore dust in the Japanese beetle retardation program under the direction of Dr. George S. Langford, specialist in insect control. Mr. James R. Foster, recently returned from service with the armed forces in Korea, will take over the spore dust work.

Mr. Harding in his new capacity will contact county agents to learn the pressing problems in their counties. He will search for insects in all areas of the state. His findings will be returned to State headquarters for analysis and release through the extension entomologist, Theo. L. Bissell, who will be responsible for specific recommendations on control.

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New Davison Fertilizer

Davison Chemical Corp., Baltimore, announced recently the addition of Davco 12-12-12 granulated fertilizer to its current line of supplies. The announcement pointed out that state experiment stations are increasingly recommending fertilizers in the 1-1 1 ratio for corn and other crops.

The new granulated product is said to resist picking up moisture, will not corrode machinery, or cake in storage. It flows freely, is nondusting and is homogeneous, ie, each granule contains the plant nutrients in the same proportion.

Phosphate used in Davco 12-12-12 is reported to be high in water-soluble monocalcium phosphate content and low in citrate-soluble dicalcium phosphate.

•

Bemis Names Braxtan

The appointment of J. T. Braxtan as assistant manager of the Minneapolis plant of Bemis Bag Co. was announced recently by O. M. Smith, manager. Mr. Braxtan is succeeded in his former position as office manager by R. E. Copeland.

Mr. Braxtan joined Bemis in 1934 as an auditor in the accounting and auditing department, St. Louis. He transferred to Minneapolis as office manager in 1949.

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D-Kennedy Appoints Engineer

Robert H. Hessel has been appointed chief research engineer of Davidson - Kennedy Company, Atlanta. In his new capacity he will serve as consultant to the design, engineering and sales departments. According to A. T. Kennedy, president, Hessel's appointment will increase Davidson-Kennedy Company's capacity in rendering a complete design and engineering service and in training personnel in operation upon completion of a new fertilizer plant.

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Weatherly forms Consulting Co.

The formation of the D. M. Weatherly Company, industrial engineers and builders, was announced by D. M. Weatherly. Home offices are located in Avondale Estates, a suburb of Atlanta, Ga.

Mr. Weatherly stated that this organization will offer a complete engineering service to the fertilizer industry. An important phase of company activities will be consulting engineering work. Included in this phase will be assistance to manufacturers in solving operating problems, the preparation of reports, estimates, and economic evaluations on plant expansion and improvements.

Prior to the organization of this company, Mr. Weatherly directed the design and construction of many important fertilizer production facilities. Several of these plants were the first of their type and process in the United States. He has experience in heavy chemicals, and food processing.

S. C. Fertilizer Groups Meet

Four area fertilizer meetings held during January were arranged cooperatively by the Clemson Extension Service and the South Carolina Plant Food Educational Society. The meetings were designed to promote more efficient use of fertilizer and lime in the state. A short program, on the 1954 fertilizer recommendations for South Carolina was presented and discussed at each session, at which district agents of the Extension Service presided. Orangeburg, Hartsville, Columbia and Spartanburg participated in the program.

The meetings although planned primarily for fertilizer dealers, were attended by farmers, county agents, and other agricultural agency workers.

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Mid-West Soil Group Meets

The annual winter conference of the Mid-West Soil Improvement Committee will be held Feb. 19 at the Palmer House, Chicago, it was announced by Z. H. Beers, executive secretary. Two panel discussions are planned for the one-day program, he said, one of which will deal with the objectives of soil-testing procedures and their influence on the merchandising of fertilizer. The second will cover the controversial subject of time of application of fertilizer and attempt to get at the underlying principles advocated for fall or spring application. Dr. F. W. Smith of Kansas State College will preside as chairman of the committee and panel members will include outstanding authorities in the field of soil improvement drawn from midwestern state agricultural colleges.

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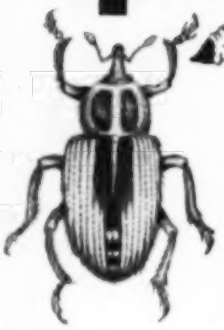
Cotton Mechanization Conf.

Pre-harvesting cotton production practices will be featured at the eighth annual Beltwide Cotton Mechanization Conference scheduled to be held in Little Rock, Ark., July 28-30, according to a recent announcement by C. L. Welch, National Cotton Council. R. F. Shaw, North Carolina Farm Bureau Federation is chairman of the mechanization conference steering committee.

heptachlor



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When one alfalfa grower meets another, there's only one bit of advice he offers for control of alfalfa weevil adults—"Get HEP". That's Heptachlor he's talking about, the most economical insecticide he can buy for control of alfalfa weevils. "Get HEP", he says, because he used HEP last year—as did thousands of other growers. He knows it's really effective, economical, easy to apply. It's the best protection and profit insurance he can buy. So this year, too, he'll treat his fields with Heptachlor. He'll get HEP, and he'll get it from *you*, if you place your orders now for early delivery. It's alfalfa weevil time, and that means it's time for added profits if you get HEP—and get it right away!

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REPRESENTATIVES IN PRINCIPAL CITIES

Inter. Minerals Names Sibley

The Plant Food Division of International Minerals & Chemical Corporation promoted James H. Sibley to the position of sales manager of its Clarksville, Tenn., district, according to a recent announcement by Maurice H. Lockwood, vice president in charge of the division.

In his new position, Mr. Sibley will be in charge of sales in the Clarksville district and will direct an intensive information campaign on the proper use of plant foods. A new fertilizer plant being built by International to serve the district is expected to be in operation in time for the spring planting season. It will serve an area of about 150 miles around Clarksville.

Mr. Sibley joined the Plant Food Division in 1952 as a sales representative in the middle Tennessee and northern Alabama areas. He comes from Franklin county, Alabama, and was graduated from Alabama Polytechnic Institute, at Auburn, with a degree in agricultural education.

JAMES H. SIBLEY

He served in the U. S. Air Force during World War II and was a coordinator of the Veterans Farm Training Program before becoming associated with International.

NH$_3$ Shortage Expected

The use of agricultural ammonia as a nitrogen fertilizer for farm crops will spread to many new areas this year, predicts E. W. Thomas of Boonville, Missouri, newly elected president of the Agricultural Ammonia Institute.

Despite a Government-announced forecast of a 20 per cent greater over-all supply of agricultural ammonia, Mr. Thomas believes the demand from these new areas, plus increased demand from farmers, who have used ammonia so successfully during the past several years, will again create a shortage of ammonia during the April, May and June period of heavy application.

Agricultural ammonia contains 82% pure nitrogen and increasing numbers of the nations farmers are finding it to be the most economical and satisfactory method of making essential nitrogen available to their crops.

Mr. Thomas, heads the Farm Service Corporation, an agricultural ammonia distributing firm operating in Central Missouri, and became head of the Agricultural Ammonia Institute on January 1st, succeeding Jeff I. Davis of Albany, Georgia. He is also president of the Great Plains Agricultural Ammonia Association, a midwest regional group.

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N.Y. Farm Expert Dies

Dr. Arthur B. Buchholz, 67, former director of the bureau of plant industry for the New York State Department of Agriculture and Markets, died recently of a heart ailment. Prior to his work with the Bureau, Dr. Buchholz served for 17 years as agriculture agent for Columbia County.

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Schumacher Pres. SAACI

W. F. Schumacher was installed as 1954 president by the Salesmen's Association of the American Chemical Industry at its January meeting. Mr. Schumacher, elected by mail ballot along with other officers and directors of the association is with the J. T. Baker Chemical Co., Phillipsburg, N. J. Other officers include: J. F. Henry, Adams-Henry Chemical Co., as vice president; E. L. Collins, Chilean Nitrate Sales Corp. treasurer; and V. L. Rehak, Grace Chemical Co. secretary.

Fertilizer Symposium by AIChE

A symposium on "Chemical Engineering in the Fertilizer Industry" is among the events scheduled to be held at the national meeting of the American Institute of Chemical Engineers, March 8-10, Statler Hotel, Washington, D. C. The following papers are scheduled for the symposium:

"Trends in the Fertilizer Industry," by E. C. Kapusta, National Fertilizer Association, Washington, D. C.; "A Continuous Ammoniator for Superphosphates and Fertilizer Mixtures" by L. D. Yates, F. T. Nielsson, and G. C. Hicks, Tennessee Valley Authority, Wilson Dam, Ala.; "Continuous Process for Production of High-Analysis Granular Mixed Fertilizer of High Ammonium Nitrate Content," by S. J. Martenet, E. Rauh and Sons Fertilizer Co., Indianapolis; "A Pilot Plant Study of A New Process for Manufacturing Ammonium Nitrate," by J. J. Dorsey, Jr., Commercial Solvents Corp., Terre Haute, Ind.; "The Chemico Urea Process," by Lucien H. Cook, Chemical Construction Corp., New York; "Factors Influencing the Changing Technology of the Fertilizer Industry," by R. B. Filbert, Jr., Battelle Memorial Inst., Columbus, Ohio.

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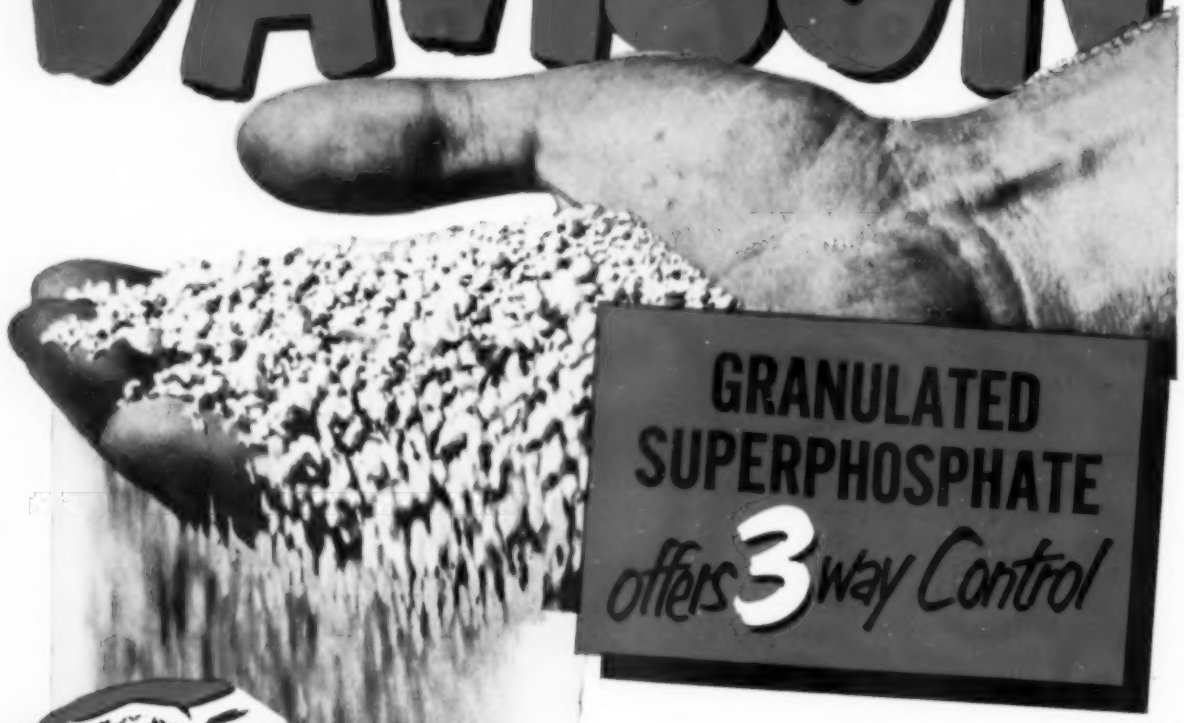
Kangas Joins A. Noble

John Theodore (Ted) Kangas has been named chief agricultural copywriter for Albert Sidney Noble Advertising, New York City. A graduate of Cornell University (College of Agriculture), he has had extensive experience in the agricultural and chemical field. He was formerly associated with Batten, Barton, Durstine & Osborn, Inc., as agricultural copywriter, and prior to that he served as extension and experiment station editor at the University of Maryland. During the war he acted as information specialist and acting chief of the information division for the War Food Administration in the New York region. Mr. Kangas was also affiliated with New York State College of Agriculture as an agricultural newswriter. The appointment is effective immediately.

DAVISON



GRANULATED SUPERPHOSPHATE offers 3 way Control

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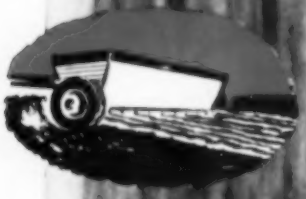

2. APPLICATION CONTROL—drills free and even . . . does not bridge over in the drill.

3. FOOD CONTROL—supplies uniform amount of plant food at desirable rates.

Davison's Granulated Superphosphate with 3-way control can mean added sales for you!

No longer is it necessary for you or the farmer to worry about lumping or caking . . . Davison's Granulated Superphosphate will store without becoming hard or caked. And when the farmer starts to apply Granulated Superphosphate in the field he will find there is no dusting nor will it bridge over in the drill. Granulated Superphosphate drills freely and evenly giving complete coverage. Because of the granular structure, plant food is released at desirable rates.

For added sales points be sure to get *Davison's Granulated Superphosphate with the 3-way control!*

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NEWS Brevities

FLY CONTROL AND toxicity hazards of insecticides are on the schedule for the eighth annual PCO short course at Pennsylvania State College, March 2-4. Any Pest Control Operator is eligible to attend the course, registration fee for which is $20.

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INCORPORATION OF Mitchell Insecticide Co., Fairfax, S. C., has been announced by the company's president, Billy G. Mitchell. Firm has authorized capital stock of $5,000 to own and operate a plant for manufacture, sale and distribution of insecticides.

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THE PENNSYLVANIA Salt Manufacturing Co. announced recently the appointment of Otto T. Aepli as chief chemist of their Wyandotte, Mich., plant. Formerly assistant chief chemist, Aepli replaces Earl Sweetland, who retired recently.

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PAUL WIEMER Co., Cincinnati, is new distributor for Universal Detergents, Inc. Announcement was made by B. R. Bryant, general manager of Universal, which makes Udet and Udex surface active agents.

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FILLING THE NEWLY-CREATED post of director of manufacturing control at Diamond Alkali Co. is David E. Pierce, chemical engineer, author and lecturer. A. H. Ingley, vice president in charge of manufacturing, said Pierce is appraising manufacturing operations at Diamond's 14 plants throughout the country.

•

A FIVE PER CENT drop in production of superphosphate last November from the same month in 1952 was reported by the Department of Commerce. Production totaled 157,285 short tons, a decrease of seven per cent from October, 1953. Shipments were down 10 per cent in November from 1952, while stocks on hand were up seven per cent.

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RICHARD J. KENYON has been transferred by Phillips Petroleum Co. to the Tulsa sales division, as assistant division manager in charge of fertilizer sales.

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A LIST OF FERTILIZER dealers in the Pacific Northwest is being compiled by the Soil Improvement committee of the Pacific Northwest Plant Food Association. The list will be for confidential use by the committee.

Another current project of the committee is the assembling of deficiency symptom slides. When completed, the collection will be loaned to any organization interested in the use of fertilizers.

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FAIRFAX BIOLOGICAL LABORATORY, Clinton Corners, N. Y., has purchased the Edgar A. Murray Co., of Detroit, one of the oldest manufacturers of household insecticides. The Murray company will be operated as a division of Fairfax.

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CAIRO FERTILIZER Co., Cairo, Ga., has been purchased by a new company in the same city, Graco Fertilizer Co. Cyrus T. Helm, president of Graco, said the company will expand and modernize the Cairo plant.

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WILBUR ELLIS Co. has purchased the Portland, Ore., plant of Marine By-Products Co. and will operate it as Marine By-Products Division, with Ed Asbill as manager, succeeding Peter Harris.

THE NICHOLS Seed Co. recently purchased the insecticide manufacturing equipment of Agricultural Chemical Co., and will move it to Jones, Okla. It has a daily capacity of 20 tons of dust insecticide and 100 barrels of liquid. Operation is expected to begin about February 15.

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THE USDA HAS ENTERED into two barter transactions with western Europe, involving exchange of USDA owned agricultural commodities for fertilizer to be sent to Korea for use under the Foreign Operations Administration.

CCC-owned commodities will be exported in exchange for superphosphate and ammonium sulfate.

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PURCHASE OF ALL outstanding stock of Pulverizing Machinery Co., Summit, N. J., was expected to be completed late in January. Metals Disintegrating Co. Inc., of Elizabeth, N. J., announced last month it had entered into an agreement with the Summit company to buy the stock. Pulverizing Machinery is the manufacturer of the Mikro-Pulverizer, a wide range of dust collectors and the Mikro-Air Conveying system.

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A POLL OF PRESS and public relations personnel interested in agriculture is being made by the National Project in Agricultural Communications in order to set up mailing lists and determine their willingness to contribute to the project. It will assist land-grant institutions and the USDA in using mass communications to develop and maintain educational services for farmers, homemakers and the general public.

•

ANHYDROUS AMMONIA WILL be transported in bulk by water for the first time this year, according to a plan announced by Shell Chemical Corp. George R. Monkhouse, of San Francisco, vice president in charge of the company's newly created Ammonia Division, said shipment of ammonia will be made from Shell's plant at Pittsburg, Cal., over a 900-mile ocean and river route to Portland, Ore. and Pasco, Wash.

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shed water resist abrasion and stay cleaner!

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Yes, Arkell & Smiths' extensive tests prove that DUK-PAK has greater resistance to exposure, moisture and to weather — like the proverbial you-know-what! What's more, DUK-PAK has a special, "built-in" reinforced quality which makes it resistant to scuffing and abrasion. Where ordinary multiwall bags might "give-way" under rough handling, DUK-PAK holds its own, longer. This adds up to:

1. **DUK-PAK provides dependable packaging for products that don't like water, moisture, or dirt, and**
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WASHINGTON *Report*

by
Donald G. Lerch
Cornwell, Inc., Washington, D. C.
(Agricultural Chemicals Washington Correspondent)

MOST of the technical provisions of the new Miller Bill, H.R. 7125, pertaining to residues, meet the approval of the Food and Drug Administration in the opinion of George P. Larrick, Deputy Commissioner of the Food and Drug Administration. "The Food and Drug Administration is very grateful that the leaders of the agricultural chemical industry have proposed this forward step in the interests of public health," Mr. Larrick said. He will be especially remembered by many members of industry who heard his address during the fall meeting of the National Agricultural Chemicals Association at Spring Lake, N. J., last September.

General agreement is also voiced by NAC. Lea S. Hitchner, executive secretary, holds the new bill to be — "in the public interest and a practical, realistic approach to regulating the use of farm chemicals to protect crops against pests."

Consequently, at this writing, there appears to be no major opposition to the bill and it is expected to be favorably reported out by the House Interstate and Foreign Committee. Its fate then depends on the adroitness of the parliamentary maneuver to steer it through to a favorable floor vote.

Congressman Miller, (R. Neb.) emphasizes that the bill would treat agricultural chemicals under the Food and Drug Act as a separate entity from chemicals used in the processing of foods and thus permit the special treatment which this class of chemicals deserves. In this respect and in most other features, as well, the new Miller Bill is similar to the previous bill he introduced at the first session of this Congress.

A major change in the opinion of many industry men is elimination of the provisions calling for "de novo" court procedure in cases of dispute. The new bill would provide for a court review in a manner generally prescribed in other regulatory statutes.

One of the points likely to receive major attention during Hearings is the matter of fees. As a matter of policy, Food and Drug will request fees to cover "expenses." However, it is generally felt here that the extent of fees should be fully defined and held at an absolute minimum. NAC is expected to oppose the payment of fees on the basis that it is discriminatory.

The new bill is considered by NAC to provide five improvements over the existing Food and Drug Act. They are: (1) Consumer protection by limiting residues; (2) establishment of a residue tolerance within a specified period after a request has been made; (3) provides standards for basing directions for use; (4) establishes standards for basing enforcement activities; (5) it aids growers in their compliance with the law.

Assuming that hearings on the revised Miller bill are brief, one or two days at most, the next major step is preparing the measure for House vote. It appears there is a good chance for the bill to be placed on the consent calendar. If this is done, observers believe it will "breeze through" as the House fights against time on so-called Administration must bills — which this is not.

A re-survey of several key Congressmen shows that the Miller bill is still considered non-political despite the almost complete reversal of attitude toward agricultural chemicals since the change in Administration. The general reception of the Miller bills has been and continues to be friendly. This is in direct contrast to the chilly treatment by some members and staff of the Delaney Committee during the Democratic Administration.

It should be remembered that an objection by any Congressman can kill passage on the consent calendar. This would place the measure in competition with scores of other bills which will be debated at length before passage. The Miller bill isn't made for this kind of competition.

This is why many industry leaders are saying that all agricultural groups supporting the measure should make their views known to their Congressmen actively supporting the bill. It is usually advisable to create as much active support as possible. Congressmen actively supporting the bill can be highly effective in persuading their colleagues to come around.

Thus the next 8 to 12 weeks are crucial. Passage in the House is seen here as the biggest hurdle. Senatorial approval is considered likely. But of course, can not be taken for granted.

* * * * *

Leaders of both the fertilizer and pesticide industries have a big stake in farmer reaction to the pending cut in corn acreage. The corn belt is being eyed by both groups as the market of the future.

Industry men like the "business sense" of the mid-western farmer — they like his logical approach to a problem. At meetings through-

MAJOR FERTILIZER MANUFACTURERS PROVE UDET F VALUES

To offset variations in raw materials, atmospheric conditions, plant equipment and manufacturing methods, several prominent fertilizer makers ran analyses of both UDET F treated and untreated materials over extended periods of time.*

NOW CONSISTENT USERS

Results are in, and in every instance UDET F gave better conditioned piles ex-den, and complete analysis revealed lower insolubles. Conclusive proof: In every instance, manufacturers who made these tests are now consistent users of UDET F!

IN ACIDULATION

UDET F, molecularly designed for fertilizer manufacture, is heat and acid stable, is up to 3-times more effective than competing products in the presence of calcium ions.

IN AMMONIATION

UDET F, instantly soluble, disperses completely in the mix. Permits higher absorption of ammonia.

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UDET F inhibits cake build-up and equipment fouling. Increases production through less "down" time.

UDET 90-95F — a 90-95% active granular powder.
UDET 50 F—a 50% active free-flowing liquid.

TYPICAL UDET F RESULTS

- Den time reduced
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*Production facts and figures are available. Write for your copy.

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U D E T

out the country you hear industry men talk enthusiastically about the tremendous potential in the mid-west.

That's why the forced reduction in corn acreage comes as a jolt, though not entirely unexpected. And a 17 percent reduction isn't just a little drop either. It's big — and even bigger when you consider that it applies to the commercial corn areas — meaning the best in the United States.

On the optimistic side, industry men say — now there is all the more reason for farmers to use more fertilizer per acre — follow a complete protection program and so produce more per acre. This could give a real boost to the comparatively new spray programs in the mid-west. It could mean a good demand — high enough to more than offset the acreage cut.

Fertilizer leaders say — now by all means farmers should follow the recommendations of their experiment stations. Some estimate that farmers in many parts of the country have been using only half as much fertilizer as officially recommended. Here again, using as much fertilizer as experiment stations say is profitable can more than make up for the USDA's acreage reduction program.

It looks like 1954 will provide a stern test of salesmanship.

* * * * *

The American Plant Council's new agronomist, Dr. Willard H. Garman, comes to his new post at a time when the industry is fighting to keep fertilizer usage on the increase. He assumes a major responsibility as he acts as the industry "catalyst" in relations with manufacturers and his fellow scientists.

Commenting on the appointment made by Council President Paul T. Truitt, a spokesman for the agricultural experiment stations, R. W. Trullinger said, "although we regret losing scientists of Dr. Garman's abilities, we are glad that he is advancing to a position of leadership that will enable him to maintain close contact with directors and soil scientists at state experiment stations."

* * * * *

Value of community cotton insect control projects is well supported in recent findings reported by Dr. Harold H. Shepard, USDA's Commodity Stabilization Service. He shows the dollars and cents growers made from community spray programs.

For instance, he tells about nineteen adjoining fields in central Texas, where a complete control and protection program was followed. In another nearby community, no insecticides were used on a comparable area, but all other factors were the same. The results show the control program made an extra $54.00 over expenses. A second similar test showed an even greater advantage, reaching $74.00 per acre.

Dr. Shepard has also uncovered cost records demonstrating the small cost outlay per acre for crop protection required in many cases. The latest figures for Oklahoma covering 1952 show, Dr. Shepard says, that cotton growers averaged between 2 and 3 applications of insecticides. Slightly over 337 thousand acres were treated at a cost of $812,000. The average cost per acre accordingly was $2.41.

On a national basis, the cost of application, exclusive of materials, is estimated at 50 cents an acre for dusting and 75 cents for spraying.

Commenting on future insecticide requirements of cotton areas, Dr. Shepard says, "the study of past trends in consumption and the consideration of expected changes in insect control practice are the most reliable means of determing requirements of insecticides. Changes in total cotton acreage are significant in estimating requirements only if they affect specific areas where the rate of consumption is reasonably uniform from year to year."

With a continuing scramble for cotton acreage among states, counties and growers to get the best possible deal under the government's acreage reduction program, Dr. Shepard's observation seems particularly appropriate. He comes up with this conclusion about the cyclic nature of the cotton insecticide business. "The history of calcium arsenate production shows that more cotton insecticides may be sold the year following — than during a peak year itself of boll weevil activity. When demand suddenly disappears, the manufacturers find themselves with capital tied up in considerable inventories involving serious storage problems," Dr. Shepard reminds.

* * * * *

The old Bureau of Entomology and Plant Quarantine has not only been re-organized, divided and renamed, but sizable segments of it have been physically moved out of Washington. New location for most of the research entomologists is Beltsville. That's where you'll find Dr. Edward F. Knipling, Chief of the Entomology Research Branch and his staff. Other divisions are still in Washington.

Official new titles of other former BEPQ heads are: W. L. Popham, Chief, Plant Pest Control Branch; Avery S. Hoyt, Director, Crops Regulatory Programs; Dr. Herbert L. Haller, Asst. Director, Crops Research.

General feeling is that it's only the beginning of the shake down period. Lots of administrative questions are unsolved. The transfers and shifts have created many personnel problems as well. Certainly no part of the Department underwent a greater change than entomology. Some government men say it will take six months or more before the new setup begins to run effectively.

•

Phosphates Plant Completed

Construction of the Western Phosphates plant at Garfield, Utah was scheduled to be completed early in February. Initial operations of ore grinding and phosphoric acid facilities started in January. Production of triple superphosphate will start sometime this month, and the initial production of 11-48 ammonium phosphate will be started in March or April. The company is owned jointly by American Smelting and Refining (25%), Kennecott Copper (25%) and Stauffer Chemical Co. (50%). Annual production of the plant will be about 90,000 tons total for all three products.

KNOWING YOUR ONIONS

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Technical
SECTION

Electrical Control of Insects Studied

B. H. H. Slawson

SOME equipment purporting to make use of electrical means for control of insect pests "was undoubtedly designed to fool the public," in the opinion of investigators reporting on the subject before a recent meeting of the American Society of Agricultural Engineers in Chicago. A paper reviewing the entire subject of possible use of electromagnetic energy to control insects infesting wheat, flour and other stored food products was read by Dr. V. H. Baker, research associate professor at Virginia Polytechnic Institute, who reported on a research project conducted jointly by himself, Dr. D. E. Wiant, professor of Agricultural Engineering at Michigan State College, and O. Taboada, graduate student in entomology at Michigan State.

"One machine which is nothing more than a resistance coupled amplifier," he went on, "has been used to fool farmers into believing that various insecticides could be broadcast by means of radio waves. At least one farmers' organization actually contributed funds for the development and use of this machine. There is no scientific evidence, hypothesis or theory which hints that such a machine will work, and the inventors of the process have not demonstrated that the process is effective."

Realizing that more information was needed on electric insect control before definite recommendations could be made, Dr. Baker and his two associates conducted a series of tests with various forms of electromagnetic energy. Included were radio waves, micro waves, infrared and ultraviolet energy.

No particular resonance effect of radio waves or micro waves on tissue was observed, the only effect noted being that of heating caused by molecular agitation. There does not appear to be any particular frequency which has a selective effect on insects, it was concluded.

The tremendous amount of energy required to kill insects in free space with electromagnetic waves from an antenna, Dr. Baker declared, "would be so high as to make this process impractical." The high field strength required, he said, "would undoubtedly cause a corona discharge which would heat the plants as well as any animals in the area."

Radio frequency dielectric heating between the plates of a condenser, Dr. Baker continued, "is an excellent process for penetrating into non-conductors and causing high temperatures throughout a mass of material in a short time. Some machines have been developed which will penetrate as much as one foot or more of wheat and cause a temperature rise of 100° F. in a few seconds."

Flour, wheat and similar products are good absorbers of dielectric energy, he stated, but the hypothesis that there would be selective heating between the wheat and the insects in it, he asserted, "does not appear to have merit, because it was necessary to raise the temperature of the mass to the lethal temperature of the insect before a 100 percent kill was obtained."

For treating large masses of grain by the dielectric method, Dr. Baker added, the cost of energy and equipment, as compared to the cost of energy from a coal or oil furnace, "would make this process impractical to use for insect control at the present time."

Infrared energy can be used to kill insects, Dr. Baker stated, "provided that the lethal temperature of the insect is obtained. Infrared energy, however, only penetrates matter superficially and this factor, together with the relatively high cost of operation per pound of product heated, he declared, would limit use of infrared energy for insect control."

Visible and ultraviolet light can be used to attract insects to an area, he continued, but some means, such as an electric high voltage grid or some type of mechanical trap must be used to kill the insect. While ultraviolet energy will sterilize insect eggs, it penetrates only superficially into wheat, flour and many other materials, so it is impractical, he concluded, to use ultraviolet as a direct lethal agent for insects.

X-rays, he went on, have been used to create short and long range mutations in insects but "do not appear to have any practical application as far as insect control is concerned. . . . Even though X-rays do have a relatively deep penetration into materials which insects infest, it is likely that a dose sufficiently strong to cause short time lethal effects to the insects will also cause damage to the materials which the insects infest." Gamma radiation presents somewhat the same problems as do X-rays, Dr. Baker said.

Problems involved in effective utilization of accelerated electrons appear to be closer to solution than for other types of radiation, Dr. Baker continued. He saw "interesting possibilities" for using them to penetrate wheat and flour. Installation and maintenance costs of equipment involved may limit the extent to

which accelerated electrons can be used in the immediate future, he pointed out. He recommended that studies be made to determine the effects of accelerated electrons on the nutritional values of wheat, flour and other foods.

"In the final analysis," Dr. Baker concluded his paper, "the application of any electrical method for destroying insects in products must be better than or as good as present methods.

"One fact which must not be overlooked is that, even if insects can be killed in stored products by electrical means, some way must be found to remove the insect fragments before the food can be lawfully sold for human consumption."

•

Stored Grain Insects

Powders and sprays containing pyrethrum and various synergists were used in a series of tests designed to protect corn and rough rice from insect damage in storage. The protective powders gave protection for approximately seven months in tests using small quantities of corn and rice. The sprays of pyrethrum and piperonyl butoxide were effective at high dosages in protecting shelled corn. Crib stored corn treated with a protective powder contained 16 per cent of the grain infested or damaged at the end of 11 months; whereas an untreated crib of corn from the same field and of equal initial infestation was 52% infested or damaged.

Crushed corn cobs impregnated with lindane using a 10 per cent lindane solution in xylol gave complete protection to *shucked* corn and rough rice for 11 months exposed to a severe insect infestation. The lindane was used at the rate of 3 grams of technical lindane per hundredweight of grain. Corn from these treatments did not cause any off-flavor to chicken eggs when the hens were fed this treated corn as their sole source of grain for 2 months. Neither was any off-flavor noted in meal prepared from corn treated with lindane. Rice treated with lindane was also found to exhibit no off-flavor. E. H. Floyd and C. E. Smith, *J. Econ. Entomology* 46, #5, pp 771-774 (1953).

TVA Develops New Nitro Phosphate Process

The pilot plant development of a nitric phosphate process was carried out in the equipment used in the investigation of the other TVA developed nitric phosphate processes. As finally developed, the process consists of the following steps:

(1) Three-stage continuous acidulation of rock phosphate with nitric acid in stainless steel tanks, each provided with a propeller-type agitator and foam breaker. The acid to rock ratio was such that the HNO_3:CaO ratio in the acidulate was about 1.8. Florida rock containing 34.6% P_2O_5 and ground to pass 35 mesh was used. Nitric acid containing 42% HNO_3 was employed. Limited tests showed that two stage extraction was satisfactory and that 20-mesh instead of 35-mesh rock could be used.

(2) Continuous three-stage ammoniation of the extraction slurry to a NH_3:NO_3 mole ratio of about 0.60 using anhydrous ammonia. Ammoniation was carried out in three stainless steel tanks, each provided with two turbo-impellers.

(3) Simultaneous addition of carbon dioxide and additional ammonia to the slurry in two additional stages. This operation is necessary to convert the remaining calcium nitrate to ammonium nitrate and calcium carbonate. The amount of ammonia used was sufficient to increase the NH_3:NO_3 mole ratio in the slurry from 0.60 to 0.95. One mole of carbon dioxide was added for each mole of ammonia. About one-fifth of the ammonia and carbon dioxide was added to the first of these tanks and the remaining four-fifths to the second. Most of the added carbon dioxide passed through the slurry or was lost in further processing steps. However, enough was retained to prevent occurrence of calcium nitrate in the product. No tests were made to determine the minimum amount of carbon dioxide necessary to insure complete elimination of calcium nitrate from the product.

(4) Addition of potassium chloride to the slurry if a three-component fertilizer is desired, and

(5) Two-stage drying of the resultant slurry. In the first stage the moisture content of the slurry was reduced from about 30 to 10 per cent in a rotary drier. Recycled fines and oversize were added to the drier discharge in a double shaft paddle mixer. The resultant mixture, containing about 4 per cent water, was dried to a moisture content of 1 to 2 per cent. About one-third of the product from the final drier was in the form of granules having the desired minus 6 plus 50 mesh size. About 99 per cent of the total P_2O_5 content was in an available form, and about 1 per cent was water soluble.

Tests indicated that the addition of a small amount of soluble sulfate or of calcium sulfate during acidulation or in an early stage of ammoniation prevented the reversion of P_2O_5 to citrate-insoluble form during ammoniation.

Tobacco Hornworm Control

Lead arsenate has long been the most widely used insecticide for control of the tobacco hornworm; but both lead and arsenic are cumulative poisons and entomologists have conducted experiments to find a more suitable insecticide.

Toxaphene was found to be very toxic to hornworm larvae, but caused an objectionable flavor and aroma to cigarettes made from the treated tobacco. TDE, endrin, CS-708, and metacide show promise for hornworm control. Poor results were obtained in tests using ryania plus a synergist, and EDN plus methoxychlor.

TDE dusts and sprays were found to be effective against hornworms, safe for use on tobacco foliage, and to have no adverse effect on the flavor and aroma of the tobacco; except in emulsifiable concentrates containing petroleum distillates. N. Allen, C. R. Hodge, A. R. Hopkins, J.D. Early, *J. Econ. Entomology*, 46, # 4, pp 605-608 (1953).

Plant Reaction to Treated Soil

In soil treated with aldrin, hollyhock was somewhat retarded by all dosages, and beets, corn, radishes, verbena, and zinnia (Spun Gold) by the 6-pound dosage. With dieldrin, spinach and tomatoes (Marglobe) were retarded by the 3- and 6-pound treatments, and carrots, dianthus, hollyhock, radishes, and verbena by the highest dosage. With endrin, cucumbers, dianthus, and scabiosa were retarded by 2 and 4 pounds per acre, and centaurea, eggplant, and tomatoes (Marglobe) by 4 pounds. With isodrin, only scabiosa was significantly retarded by the highest dosage used. With heptachlor, corn, soybeans, and tomatoes were significantly retarded by the highest dosage. With lindane, corn was retarded by all dosages eggplant by 4 and 8 pounds per acre, and soybeans, peppers, and tomatoes (Garden State) by 8 pounds.

The effects on the growth of the plants in soil treated with various dosages of insecticides are shown in three tables.

When these insecticides were used at rates required to kill third-instar Japanese beetle grubs, all the plants grew normally in the soils treated with isodrin and heptachlor, 97 percent in soil treated with aldrin, 95 percent with dieldrin, 90 percent with endrin, and 79 percent with lindane. When the dosage was increased, additional plants were retarded in growth. By W. E. Fleming and W. W. Maines, Bulletin #E872, 8 pp, U.S.D.A., B.E.P.Q.

•

Spray Concentration Studies

Doubling the amount of active spray ingredient in the spray tank does not double the amount retained on the leaf surfaces of the crops to be protected — at least in the case of some sprays, according to Dr. Rich, Connecticut Agricultural Exp. Sta.

A series of experiments to determine optimum spray concentration were conducted with Bordeaux mixture and zineb, applied separately to beans and celery, in varying concentrations at weekly intervals. In the case of Bordeaux mixture the gain in deposit became less and less when using spray liquids more concentrated than 4-2-100 (4 lbs. of copper sulfate and 2 lbs. of lime per 100 gallons of spray). Below 4-2-100, doubling the concentration of the spray liquid, doubled the amount of Bordeaux deposited on the leaf. Above 4-2-100, doubling the concentration gave an additional increase of deposit of only 10 to 20 per cent.

Zineb acted differently. Deposits rose quite regularly as concentrations were increased, although all eight concentrations of zineb used were much lower than the Bordeaux dosages, as is the case in actual agricultural practice. According to Dr. Rich, the different behaviours may be explained by the laws of absorption. The studies also indicated that dried spray residues on hairy leaves, such as beans, were more resistant to weathering than on smooth leaves, such as celery.

•

Esteron 245 as Tree Spray

Esteron 245 is reported to be effective as a silvicultural tool. Mixed with water, it can be used advantageously as a foliage spray on woody plants up to eight feet tall. Trees larger than that, and up to six inches in diameter at the ground, can best be treated with a basal spray of Esteron 245 in oil. This latter technic is particularly useful in selective deadening of unwanted unmerchantable stems where a residual stand is to be retained. It is also a means of treating cut stumps to prevent sprouting. *Down to Earth* (house organ of Dow Chemical Co.), 9, No. 3, p. 5 (1953).

Cl-IPC Results

Good to excellent results were reported by all state testing services reporting on Chloro IPC, at the Southern Weed Conference held in Memphis, January 11-13 (see story page 81).

Chloro IPC is applied to the soil before the grasses start to grow and prevents them from germinating. Illustration shows weed growth in untreated bands, as compared with treated cotton plant rows.

Insecticides on Tobacco

Tobacco growers are warned on possible odor problems in connection with use of insecticides on growing tobacco plants in the latest annual review published by the South Carolina State Agricultural Experiment Station at Clemson, S. C. It had been suspected that insecticides applied to tobacco might impart an objectionable flavor to the cured tobacco, but there had been no direct evidence until this past season when J. M. Lewis, state extension tobacco specialist, obtained samples from a tobacco warehouse on the Hemingway market where the tobacco which had been treated with various insecticides during the growing stage, had been marked down in quality to indicate off-flavor.

His report indicated that "tobacco that had been treated with toxaphene as a dust or emulsion was found to have a strong toxaphene odor. The odor was less intense in the tobacco that had been treated with the wettable powder spray. However cigarettes made from all these samples were very objectionable to smokers." Thus the experiment station is advising growers of cigarette tobacco not to use toxaphene for insect control on their crops and, for the present, at least, not to use any insecticide in the form of an emulsion. Emulsions were found to be particularly bad from the odor standpoint.

Hercules Powder Co., Wilmington, manufacturers of toxaphene, have recognized for several years that an odor problem exists in connection with possible use of this material on cigarette tobacco, and have not recommended it for this purpose.

Air view showing dryers and rock storage at Pierce, Florida, headquarters of A.A.C. phosphate mining operations. (Top) Sample of Florida Pebble Phosphate Rock, source of phosphorus widely used in the chemical industries, in its elemental form as well as in phosphoric acid, phosphates and phosphorus compounds. ¶ This pebble rock is also the principal source of the most important—and most generally deficient—plant food element. Often called the Key to Life, phosphorus is essential in maintaining and improving crop yields. Health, growth, life itself, would be impossible without phosphorus . . . so in a way these phosphate pebbles are more precious than gold.

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Chlordane Increases Yields

Destroying soil insects and related pests with the insecticide, chlordane, increases sugarcane yields by preventing root-feeding damage and, in turn, the entry of rot organisms into pest-inflicted root wounds, according to recent reports by entomologists of the U. S. Department of Agriculture.

Five years of cooperative field tests by the USDA's Agricultural Research Service and the Louisiana Agricultural Experiment Station, applying the insecticide to plantings in heavy Louisiana soils, resulted in an average increase in both cane and sugar of more than 12 per cent over untreated plantings. Use of chlordane increased the average yield of cane per acre from 21.3 to 24.1 tons, and sugar from 3,852 to 4,315 pounds.

Research entomologists obtained these gains by applying chlordane as a 1 per cent dust at the rate of two to four pounds of actual insecticide per acre. Put on by hand or with a fertilizer distributor during fall planting, the material was dusted into open furrows containing cane seed pieces. Cost of insecticide and application was estimated at $4.50 an acre, which compares with an annual average cash gain from increased yields on treated fields of around $18 an acre during the test years, 1948-52.

Two tests, conducted to determine the carry-over effect of chlordane into the second year after application, showed even greater yield increases in the second than the first year. Use of chlordane at the rate of two and four pounds per acre on ⅓-acre field plots upped sugarcane yields 12 and 9 per cent, respectively, the first year after treatment, but 23 and 32 per cent the second year. Four pounds of chlordane per acre on 1/50-acre plots increased yields over untreated cane plots 16 per cent the first year, nearly 20 per cent the second year.

•

CMU For Asparagus Plots

The latest crop use for which CMU has been recommended is at two to four pounds per acre of asparagus planted beds, in the control of annual weeds and grasses. Field tests have shown that as little as two pounds of CMU per acre applied only once in the growing season, has kept asparagus beds free of weeds for eight weeks or more.

Unlike 2,4-D and other organic chemicals used for weed control, CMU does not kill plants by absorption through the foliage and translocation to other sections of the organism. Its entrance is made through the roots, from which it is carried upward in the plant. Effectiveness of the chemical may vary, depending on rainfall, type of soil, or depth at which root systems of weeds and grasses are located. While CMU is generally conceded to be non-selective, certain plants such as pineapple, sugar cane, and asparagus show sufficient tolerance for the chemical to allow its use within recommended limitations to kill weeds without injuring the crop. *DuPont Agricultural News Letter* 22, No. 1, pp 4-5 (1954).

•

Soil Residue Studies

The problem of the translocation of soil insecticide residues in crops has been studied using a mosquito larvae bioassay method. Residues of DDT, BHC, toxaphene, chlordane, aldrin, and dieldrin are shown to persist in the soil, a sandy loam, for at least 3 years, although toxaphene and BHC appear to lose a large portion of their toxicity during this period. EPN and parathion completely disappear in less than 3 years after application.

Heptachlor was found to be deposited in potato tubers grown in soil treated the same year; aldrin and EPN showed evidence of deposition as long as 2 years, and BHC, chlordane, and dieldrin were found in potatoes 3 years after the soil was treated. L. C. Terriere and D. W. Ingalsbe, *J. Econ. Entomology* 646, #5, pp 751-753 (1953).

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Control of Cotton Pests

The boll weevil is reported to constitute an exception to the general order of insecticide toxicity. Of the ethyl and methyl homologs of nine phosphoric acid esters tested against four cotton pests, the ethyl compound is usually more effective against the cotton aphid, the desert spider mite, or the cotton leafworm but not against the boll weevil.

In the development of new phosphorus compounds for the control of the boll weevil, it is reported that compounds having methyl substituents should receive priority. E. E. Ivy, *et al, J. Econ. Entomology* 46, #4, pp 630-633 (1953).

•

Aramite-S Compatibility

Studies of the quantitative persistence of Aramite and of Aramite-sulfur residues on cotton, lima bean, and lemon foliage demonstrate the field compatibility of Aramite and sulfur. The presence of sulfur in the formulations apparently does not affect the half-life values (time required for given deposit values to decrease by one half) of the resulting residues. Aramite spray residues on lemon foliage persisted much longer than did dust residues on cotton and bean foliage. F. A. Gunther, and H. T. Reynolds, L. Jeppson, *J. Econ. Entomology* 46, #4, pp 674-676 (1953).

•

Fungicide Studies

Tests of various fungicides confirmed the known effectiveness of the organic mercury preparations, but showed that the less well known products based on tetramethylthiuram disulfide were still more effective. The longer the contact of the fungicide with sugar beet seeds before planting, the better was the fungicidal control without in any case an adverse effect upon the germination of the seeds. A. Canova and R. Baldoni, *Ann. sper. agrar.* 7, pp 385-393 (1953).

•

Toxaphene Controls Lygus

Reports from various sections of the country appear to indicate that lygus bugs are building up resistance to DDT. Field men have insisted they couldn't kill lygus in alfalfa seed fields in 1953, and have had to turn to other chemicals like toxaphene. Good results were reported with 3 to 4 pounds of toxaphene by H. Menke of Andrews Seed Co., Yakima. *Farm Management* 3, No. 1, p. 12 (1954).

Trouble for crop pests starts here

If you were to glance behind the agricultural research scene at Rohm & Haas, you would say: "The future is going to be rough on farm pests." And you would be right! Research and development of agricultural chemicals is hitting a faster pace than ever before at the research laboratories and experimental farms of Rohm & Haas Company. The outlook for weeds, plant insects and disease is dark.

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INDUSTRY *Patents*

The information below is furnished by patent law offices of

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The data listed below is only a brief review of recently issued pertinent patents obtained by various U. S. Patent office registered attorneys for manufacturers and/or inventors. Complete copies may be obtained direct from Lancaster, Allwine & Rommell by sending 50c for each copy desired. $1.00 for Canada. They will be pleased to give you free preliminary patent advice.

2,657,864. MEANS AND METHODS OF FEEDING TO IMPACT CRUSHERS. Patent issued November 24, to Herbert J. Woock, Alhambra, Calif. The method of feeding material to be crushed into a rotary impact crusher which consists of allowing the material to freely fall towards the crusher, then gathering the material into a bunch or cluster in the course of its fall, and then allowing the bunch or cluster to continue to fall toward the impact crusher.

2,657,977. PROCESS FOR PREVENTING THE PHYSICAL DISINTEGRATION OF AMMONIUM NITRATE BY TEMPERATURE FLUCTUATIONS. Patent issued November 3, to Leonard A. Stengel and John W. Brodhacker, Terre Haute, Ind., assignors to Commercial Solvents Corporation, Terre Haute, Ind., a corporation of Maryland. A process for preventing the physical disintegration by temperature fluctuations of ammonium nitrate produced by the reaction of ammonia and nitric acid, which comprises adding and thoroughly mixing with said acid before said reaction sufficient quantities of sulfuric acid to give an ammonium nitrate product containing from about 0.25 to 5.0% of ammonium sulfate.

2,658,017. INSECTICIDAL COMPOSITIONS CONTAINING 1,2-DICHLORO-4(α,B-DICHLOROETHYL)-CYCLOHEXANE AND METHOD OF USING THE SAME. Patent issued November 3, to Edwin G. Marhofer, Fredonia, Kans., assignor to Phillips Petroleum Company, a corporation of Delaware. An insecticidal solution comprising an active insecticidal toxicant selected from the group consisting of 2,2-bis(parachlorophenyl)-1,1,1-trichloroethane, the gamma isomer of hexachlorocyclohexane, chlorinated camphene, 2,2-bis(parachlorophenyl)-1,1-dichloroethane, p-tertiary-amylphenol, and 2,2-bis(paramethoxyphenyl)-1,1,1-trichloroethane and 1,2-dichloro-4-(α,B-dichloroethyl) cyclohexane.

2,658,824. SOIL CONDITIONING AGENTS OF DESERT PLANT ORIGIN AND THEIR USE. Patent issued November 10, to Ralph W. Dickenson, Anaheim, Calif. The method of treating arable soil which comprises applying thereto and in a concentration and amount sufficient to improve the agricultural properties of the soil, a dilute aqueous solution containing water-soluble constituents extracted from greasewood plants by water leaching the plants in disintegrated form at substantially atmospheric temperature, continuing the water leaching and digestion of the water and plant mixture over an extended period of time at atmospheric temperature and forming a single non-putrifying water solution containing the bulk of the water-soluble juice content of said plants.

8,658,826. PLANT DEFOLIANT. Patent issued November 10, to Edgar W. Clarke, Laurel Springs, N. J., and Robert B. Doan, Drexel Hill, and Vincent J. Keenan, Ardmore, Pa., assignors to The Atlantic Refining Company, Philadelphia, Pa., a corporation of Pennsylvania. An improved herbicide composition of the defoliant type comprising essentially a mixture of a cyanate defoliant, and a minor amount of potassium cyanide and a wetting agent.

2,659,556. METHOD OF DISTRIBUTING INSECTICIDES OR FUNGICIDES AND STEAM JET-DRIVEN HELICOPTER FOR PERFORMING SAME. Patent issued November 17, to Friedrich L. U. Doblhoff, St. Louis, Mo. A helicopter vehicle for the aerial distribution of chemicals comprising a water tank, a pump receiving water from said tank, a boiler receiving water from said pump, a burner for supplying heat to said boiler, a steam line attached to the outlet of said boiler, a plurality of helicopter blades rotatably mounted on said vehicle, each blade having one or more steam reaction nozzles mounted on said rotor blades receiving steam from steam line for rotating the same and to discharge steam condensate or water vapor in a circular area below the blade during rotation thereof, a container for chemicals and means for the distribution of said chemicals in the aforesaid moisture laden area below said blades.

The method of aerial distribution of insecticides and the like for treatment of material in an area below, which comprises discharging water vapor under pressure in a circular path in a downward direction over and toward the area to be treated from a position above the area to be treated and simultaneously injecting the insecticide into water vapor within said circular path, above the said area to be treated and below the point of discharge of the water vapor, whereby the downwardly directed water vapor moistens the treated area, acts as a conveying medium carrying the insecticide downwardly and distributing the same for deposit over the area to be treated and moistens said area to be treated to assist in retaining the insecticide in contact with said material in treated area.

2,659,608. MEANS FOR DELIVERING LIME AND MANURE FROM MOTOR TRUCKS AND THE LIKE. Patent issued November 17, to Hereward J. B. Topp, Mauriceville, Wairarapa, New Zealand. Means for delivering lime, manure and the like material from a transport vehicle including running gear, a body including a bed and opposite side walls each terminating in upper marginal edges and defining an enclosure for the material to be delivered, a frame including skid means slidably supported on the bed of said body for movement longitudinally therealong, a power plant supported on said frame, a vertically disposed shaft carried by said frame, a rotary spinner ejector means carried by said shaft at substantially the same level as the upper terminal margins of the side walls, said shaft including a portion extending above said rotary spinner, a chute supported by said frame extending at an angle with respect to the bed and terminating in an upper end superjacent said spinner, an endless elevator including opposite ends movably mounted within said chute and including scraper means operable to transfer material from a level adjacent said bed up above and onto said spinner, said chute being disposed substantially centrally of the bed, a housing supported by the frame adjacent the lower end of the chute and extending transversely of the axis of the vehicle and terminating in opposite ends, said housing having a central opening therein accommodating said chute, a cross shaft extending within said housing transversely of the axis of the vehicle and means operably connecting one end of said elevator to said cross shaft, drive means operably connected between the upwardly extended portion of said vertical shaft and the opposite end of said elevator, and worm conveyor means carried by said cross shaft and extending between said chute and the respective opposite ends of said housing, said worm conveyor means being oppositely disposed to feed material toward said elevator, transmission means operably connecting said power plant with said vertical shaft for simultaneously operating said spinner, elevator and worm conveyor and means supported by the vehicle and operably connected with said frame for moving the frame longitudinally of the vehicle.

2,659,918. WEED DESTROYING DEVICE. Patent issued November 24, to Lewis D. Stoner, Oakland, Calif., assignor to Alston Manufacturing Co., Oakland, Calif., a copartnership composed of Lewis D. Stoner and Ralph Albertson. As an

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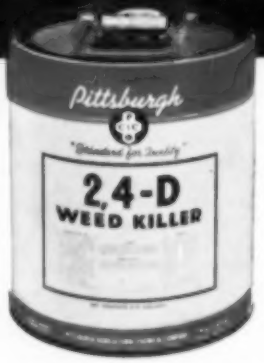

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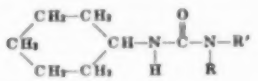
article of manufacture for the destruction of weeds, the combination of an elongated tubular handle of a length sufficient to engage the ground when held in the hand of an operator standing erect and having its ground engaging end expanded to form an axially extending tubular socket, a removable cylindrical fluid container having an open end adapted to be positioned with its closed end engaging the inner end of said socket to thereby center the container therein, a fluid absorbent applicator mounted in the open end of said cylindrical fluid container adapted and arranged to absorb fluid from the interior of said container for application to a weed, said socket also having a plurality of spaced axially extending slots forming flexible fingers that flex inwardly to engage with and center said container within the socket at its outer end, whereby a heat insulating air space will be provided within said socket and about the container that will prevent a sudden expansion of air within said cylindrical container when said socket is exposed to a raising ambient temperature.

2,661,272. 1-Cyclohexyl-3,3-Dialkylureas and Their Use As Herbicides. Patent issued December 1, to Norman E. Searle, Wilmington, Del., assignor to E. I. du Pont de Nemours and Company, Wilmington, Del. A 1-cyclohexyl-3,3-dialkylurea having the formula



wherein R and R' are alkyl radicals.

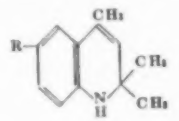
A herbicidal method which comprises applying to a locus to be protected from weeds a composition containing a 1-cyclohexyl-3,3-dialkylurea as an essential herbicidal agent in effective amount.

2,661,274. Herbicidal Compositions. Patent issued December 1, to Arthur H. Schlesinger, Dayton, Ohio, assignor to Monsanto Chemical Company, St. Louis, Mo. A herbicidal composition comprising an oil-in-water emulsion of a ketone selected from the class consisting of alkyl m-xenyl ketones and alkyl p-xenyl ketones in which the alkyl radical has from 1-4 carbon atoms, said ketone being present in said emulsion in a quantity which is toxic to plant life.

2,661,275. Herbicidal Composition. Patent issued December 1, to David T. Mowry and Arthur H. Schlesinger, Dayton, Ohio, assignors to Monsanto Chemical Company, St. Louis, Mo. The method of destroying undesired plants which comprises applying to said plants a toxic quantity of a herbicidal composition comprising methyl furfurylidenecyanoacetate as the active ingredient.

2,661,276. Herbicides. Patent issued December 1, to Arthur H. Schlesinger and David T. Mowry, Dayton, Ohio, assignors to Monsanto Chemical Company, St. Louis, Mo. A method of destroying undesired plants which comprises applying to said plants a herbicidal composition including 4-chloro-3-nitro-quinoline as the active ingredient.

2,661,277. Herbicides. Patent issued December 1, to David T. Mowry and Arthur H. Schlesinger, Dayton, Ohio, assignors to Monsanto Chemical Company, St. Louis, Mo. A herbicidal composition comprising an oil-in-water emulsion of a quinoline derivative having the formula



in which R is selected from the class consisting of alkyl and alkoxy radicals of from 1 to 5 carbon atoms, said quinoline derivative being present in said emulsion in a quantity which is toxic to plant lfe.

2,661,297. Method of Soil Stabilization. Patent issued December 1, to Conrad Lawrence Walsh, William Bernard Hawes, and Frank Fougler, Bulstrode, Gerrards Cross, England, assignors to A. S. P. Chemical Company Limited, Bulstrode, Gerrards Cross, England. A method of stabilizing soil to obtain its maximum mechanical strength which comprises reducing the soil to a particle size sufficient to pass through a 100 mesh screen, adjusting the moisture content of the soil to a value approximating that at which the soil has the approximate maximum resistance to compression, admixing with said soil 3-5% of non-starchy dried vegetable husks which will pass through a 50 mesh screen and containing as essential ingredients thereof pectates and proteins with which has been admixed a finely ground material containing about 0.75% by weight, based on the soil, of a trivalent metal sulfate, capable of forming insoluble complexes with said pectates and proteins contained in said husks, and compacting said admixed materials to a voidage of about 10%.

2,661,868. Germicide Seed Treating Apparatus. Patent issued December 8, to Andrew O. Siren, Calgary, Alberta, Canada. In a grain dusting apparatus comprising a hopper, an enclosed twin-chamber grain receiving weigher balanced on a spindle below said hopper to be automatically overbalanced by the accumulation of grain in one of said chambers at one time in an alternatively oscillating manner, a pivoted outlet gate for each of said chambers for grain discharge therefrom, means to automatically retain the opened and closed positions of each said gate at each oscillation of said weigher, a germicide dust container situated in said hopper having a dust discharge slotted aperture with slidable means to regulate the size of the aperture, means to stir the dust in said container, an oscillatory spindle-mounted shutter below said container aperture to direct and dispense the correct discharge therefrom alternately into one of said grain filled weigher chambers, and mechanism outside said container to oscillate said dust stirring means and said shutter synchronously with said weigher movements.

2,661,981. Insecticide Package. Patent issued December 8, to John A. Okie, Devon, Pa., assignor to Crystal X Corp., Lenni Mills, Pa.. An insecticidal article which comprises: (1) a sealed bag of polyethylene sheet which freely passes the vapor of paradichlorbenzene and (2) solid paradichlorbenzene in the bag, the vapor of the paradichlorbenzene passing freely through the bag and entering the air around the bag, the polyethylene sheet being exposed freely to the atmosphere on the outside and to the paradichlorbenzene on the inside.

2,663,628. Method of Making A Lignin Fertilizer Base. Patent issued December 22, to Alfred M. Thomsen, San Francisco, Calif. The method of forming a liquid ammonia fertilizer from a spent sulphite cooking liquor containing lime which comprises: adding an ammonia compound capable of precipitating the lime and substituting ammonia in the cooking liquor, adding additional nitrogen in the form of carbonated ammonia; commingling the resultant solution with potassium hypophosphite to supply added potassium and phosphorus, to form an ultimate composite suitable for use as a fertilizer.

2,663,629. Leaf or Vegetable Fertilizer. Patent issued December 22, to Waldo L. Semon, Silver Lake, Ohio, assignor to The B. F. Goodrich Company, New York, N. Y. A non-phytotoxic composition for application to the vegetable growth of plant life to provide nitrogenous plant nutrient at a controlled rate, said composition comprising a diamide of an aliphatic organic dicarboxylic acid having 2 to 7 carbon atoms, as essential nitrogen-supplying agent, together with a sticking agent consisting of natural semi-drying oils and water-insoluble, synthetic polymeric materials to promote effective contact of said nitrogen-supplying agent with said vegetable-supplying agent by dew and rainfall.

TRADE MARK APPLICATIONS

Magnite, in capital and lower case letters, red, on a green diamond-shaped background, for soil conditioners and soil fertilizers. Filed Nov. 17, 1952, by Western Mines, Inc., Pueblo, Colo. Claims use since about Sept. 25, 1952.

Bac Terra, in capital letters, with the word "terra" disclaimed apart from the mark, for fertilizers. Filed Sept. 4, 1952, by F. Marshall Smith, Reading, Pa. Claims use since July 21, 1952.

No Sucker, in capital letters, for mineral oil for use on tobacco plants. Original filed, act of 1946, Principal Register, June 18, 1952; amended to application, Supplemental Register, May 15, 1953, Serial No. 631,350, by Glover Mineral Products, Inc., Kenbridge, Va. Claims use since March 10, 1952.

Flake, in capital letters, with F and K larger, for fertilizers. Original filed, act of 1946, Principal Register, Feb. 4, 1952; amended to application, Supplemental Register, May 18, 1953, Serial No. 624,502, by Clarence R. Rex, Toledo, O. Claims use since June, 1950.

Chloro-Clad, in capital letters, for chemical treatment of grass seed. Filed

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Dec. 23, 1952, by Mock Seed Co., Pittsburgh, Pa. Claims use since Sept. 16, 1952.

CORO-P.E.P.S., in script and lower case letters, for horticultural spray. Filed Nov. 12, 1952, by Pittsburgh Plate Glass Co., Pittsburgh, Pa. Claims use since March 27, 1952.

PCL on a globe, with an airplane above it, letters "PCL" disclaimed by applicant except in connection with the mark as such, for pesticides, systemic insect poisons, insecticides, rodenticides, fungicides and weed killers. Filed Dec. 13, 1951, by Pest Control Ltd., Cambridge, England.

DE-STROY, in capital letters, for rat and mice poison bait. Original filed, act of 1946, Principal Register, July 11, 1952; amended to application, Supplemental Register, May 29, 1953, Serial No. 632, 415. Claims use since February, 1951.

BROMEX, in capital letters, for soil fumigants. Filed May 28, 1953, by Larvacide Products, Inc., New York City. Claims use since about March 23, 1953.

LP, in capital letters in a circle, for insecticides, fungicides, pesticides and soil fumigants. Filed May 28, 1953, by Larvacide Products, Inc., New York City. Claims use since about March 31, 1953.

10-20, for herbicides. Filed June 11, 1953, by Pittsburgh Coke & Chemical Co., Pittsburgh, Pa. Claims use since June 15, 1949.

STRIPE C4, with C4 above the word "Stripe," for herbicides. Filed June 11, 1953, by Pittsburgh Coke & Chemical Co., Pittsburgh, Pa. Claims use since March 15, 1953.

D-4, for herbicides. Filed June 11, 1953, by Pittsburgh Coke & Chemical Co., Pittsburgh, Pa. Claims use since Feb. 15, 1953.

GX, for insecticides. Filed June 11, 1953, by Pittsburgh Coke & Chemical Co., Pittsburgh, Pa. Claims use since Feb. 20, 1953.

AC'CENT, in capital letters, for fertilizers. Filed Dec. 24, 1952, by International Minerals & Chemical Corp., Chicago. Claims use since Nov. 17, 1952.

THRIVE, with plant entwined around letter "T," for plant food. Filed Feb. 24, 1953, by Alphonse M. Goike, doing business as A. M. Goike Co., Greendale, Wis. Claims use since June 5, 1951.

SODAN, in capital letters, for synthetic fertilizer. Filed July 8, 1953, by Allied Chemical & Dye Corp., New York City. Claims use since June 3, 1953.

CIMOTA, superimposed on farmer standing in field, with shadow forming word "Atomic," for soil conditioner. Filed Nov. 3, 1952, by Cimota Enterprises, Inc., Boise, Ida. Claims use since July 16, 1952.

GRO-FLO, with bar of letter "G" carrying over top of all letters, for fertilizer. Filed Dec. 5, 1952, by Illinois Farm Supply Co., Chicago. Claims use since Oct. 23, 1952.

FERTTOX SYSTEMIC INSECTICIDE FERTILIZER, no claim being made for words "Systemic Insecticide Fertilizer," for systemic insecticide fertilizer. Filed Jan. 15, 1953, by International Xray, Inc., Mobile. Claims use since Oct. 8, 1952.

Suppliers' BULLETINS

Hough Offers New Tractor

The Frank G. Hough Co., Libertyville, Ill., announced recently a new model of the TC-60 "Payloader" towing tractor. Refinements and modifications have been made to offer greater ease of control, convenience and usefulness. Dual-range, full-reversing transmission are provided, as well as push-button control of brake; a self-cooled torque-converter automatically reverts to fluid drive under light load conditions. Speed-range lever, and foot accelerator have been relocated for greater operator comfort. The tractor has a drawbar pull of 6,000 pounds.

•

New Emulsol Emulsifier Book

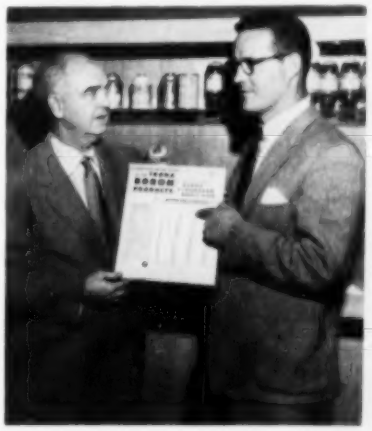
Emulsol Corp., Chicago, has recently issued a new technical bulletin (No. 39) describing "Emcol H-83A," which is a modified versatile type of pesticide emulsifier for toxaphene, chlordane, malathion, plus DDT, and certain herbicides.

•

Udet F Bulletin

Tests of the Universal Detergents wetting agent, Udet F, by several large fertilizer manufacturers, are summarized in a new bulletin available from the company. Extended periods of testing, the company states, offset variations in raw materials, atmospheric conditions, plant equipment and manufacturing methods.

Tests showed Udet F gives increased average gains in the acid-to-rock reaction speed, the bulletin reports. Materials were softer both in the pile and after bagging and storage, with insolubles reduced as much as 10 per cent. To get a copy, request Bulletin 57 from Universal Detergents, Inc., 1825 E. Spring St., Long Beach 6, Cal.



Boron Recommendation Chart

Counter display cards showing a conversion table for use in connection with the treatment of boron deficiencies in soil have been prepared by American Potash & Chemical Corporation, Los Angeles, Calif.

The cards are being distributed to all state and county agricultural authorities along the Pacific coast, as well as to customers, fertilizer dealers and mixers.

The table offers, at a glance, convenient information on the proper amounts of three different "Trona" products containing the equivalent amount of boron for any given recommendation.

The products are "Three Elephant Brand Borax" (11.3% Boron), "Tronabor" (13.7% Boron), and "Three Elephant Brand Boric Acid" (17.4% Boron).

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Schield Crane for Loading

The Natural Plant Food Co. of Oklahoma City, producer of dehydrated manure for commercial fertilizer, uses a truck-mounted Schield Bantam crane with clamshell attachment for unloading raw manure from railroad cars into stockpiles. Formerly three men, two hi-lift tractors, and a conveyor belt were used to handle manure from car to stockpile. Now one man with the truck-mounted crane Bantam handles the entire operation more rapidly and efficiently. As manure is used in the production of finished fertilizer products, the Natural Plant Food Co. rehandles it out of stockpile into hauling units.

•

New Fertilizer Scale

A new automatic scale for bagging fertilizer is described in a bulletin recently issued by Richardson Scale Co., Clifton, N. J. The bulletin tells how fast each of three models operates, how fertilizer may be fed to them, how material flowing into the weigh hopper is cut off, how discharge is accomplished and how the air system controlling the inlet works. Capacities, accuracies, and electrical equipment are also described.

•

Glyco Reports Soil Tests

Metal deficiencies in many crops can cause severe damage, low yields and even death of the plant or tree. These deficiencies may be corrected and cured by replenishing the trace metals in the soils. Iron deficiency is particularly important in citrus crops.

According to a recent release by Glyco Products Co., Brooklyn, Iron Tetrine, the iron complex of ethylenediamine tetraacetic acid, cures and prevents iron deficiencies in agricultural crops. This iron compound is reported to produce good results in curing this disease in citrus crops in the Florida acid soils. Tests and actual experience have shown this good effect is not limited to citrus crops but that the benefits can be obtained in other crops and flowering shrubs.

Iron Tetrine contains 12% iron and is a free-flowing powder. It is not hygroscopic and can be spread readily by itself, blended with carriers, or mixed with fertilizers. ⅓ to ½ pound is used in treating citrus trees by simply placing the Iron Tetrine at the base of the tree.

•

New NH_3 Injection Nozzle

A solution injection nozzle which provides better ammoniation of mixed fertilizer than can be obtained with conventional spray pipes has been developed by H. B. Davis, South Carolina sales representative for Spencer Chemical Company. About 15 fertilizer manufacturers in South Carolina are now using Davis's innovation.

The new nozzle injects solution beneath the solids to within about one inch of the mixer flights. By deflection and diffusion, this brings the solution into intimate contact with the superphosphate and potash, eliminating fumes at normal ammoniation rates, and minimizing fumes at higher rates. The inventor points out that mixer buildup and ammonia losses are practically eliminated, yielding less reversion, more uniform analysis, and a drier product.

The nozzles are available at the Thackston-Davis Supply Company, Columbia, S. C.

•

"Borospray" Plant Food

A new spray plant food for fruit trees and truck crops is being introduced by American Potash & Chemical Corporation, Los Angeles.

Named "Borospray," the new product contains a high boron content particularly adapted for use as a foliage spray on fruit trees and truck crops where boron deficiencies exist.

The product is expected to find widespread application throughout the United States in areas with low boron conditions, particularly in certain sections of northern California, western Idaho, Oregon, Washington and British Columbia in Canada.

Now being produced at American Potash & Chemical Corporation's main plant at Trona, Calif., the material has as its active ingredient sodium pentaborate. Sprayed on plants, the boron content is absorbed through the foliage.

Kennedy Van Saun Hydrator

The new Kennedy Van Saun Hydrator, which is designed to produce a thoroughly hydrated dolomite or calcitic lime without recourse to pressure hydration, was exhibited to the technical press by Lee Lime Corp., Lee, Mas., which recently installed this new equipment.

The new hydrators use a method of heat exchangers together with the use of mass reaction, which allows the hydrator to be started in cold weather and produce perfect hydrates immediately. It continues to yield specification material as long as lime is fed to it.

Although the hydrator is designed for five tons, tests runs at Lee, Mass., have shown yields as high as six tons; and it is indicated that even this capacity can be materially increased. Experience with the first installation is reported to show that the equipment can be operated by one man. Kennedy Van Saun Mfg. Co., now plans to manufacture the new type hydrator for general use in the lime industry.

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Get more N per dollar! Phillips *66* Nitrogen Solutions are well suited to the preparation of high-analysis fertilizers and the ammoniation of superphosphate. These three nitrogen solutions keep handling costs low! Promote rapid, thorough curing!

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Phillips *66* Prilled Ammonium Nitrate contains 33% nitrogen. The small, coated prills or pellets resist caking . . . handle easily. Depend on Phillips *66* Prilled Ammonium Nitrate for uniform, free-flowing properties and top-notch crop response.

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INSECTS VS MAN

(From Page 39)

collect more money with less public resentment through a 2% sales tax than he could with a much higher income tax?

How often do we fully consider what may take place in a corn field between May and October? Insects may attack the seed before it germinates, a dozen species individually or collectively may damage the root system, still others attack the juvenile plants, and last but not least a wide variety of species may attack the mature foliage, tassels, main stalks, and ears. True, all species are not abundant every year, and it would probably be unusual to find all species represented in any one field in any given season, but at the same time a dozen or more species may be encountered in varying numbers and at varying times during the season in practically any corn field. Damage attributable to any one insect may be low, but the combined effects of all the insect activity in any given field from spring until fall, if accurately measured, might be appalling.

Insecticides Increase Yield

YOU will recall that over a period of years entomologists developed what we regarded as reasonably satisfactory control measures for most of the important insect pests attacking potatoes. If pressed, we might have pointed with pride to our accomplishment in this field. If inclined to be boastful, we might even have asserted that we had about reached the pinnacle of success. And yet, what happened? When DDT, which showed promise of controlling several of the insects attacking potatoes, became available for limited use in the agricultural field in 1945, it began to replace more complicated mixtures of materials required to control a variety of pests. Reports from various sources indicated that the use of DDT resulted in phenomenal increases in the per acre yield of potatoes. The writer turned to the available agricultural statistics of the U. S. Department of Agriculture for verification of these reports. What he found is so amazing the study was extended to include many other crops. Since DDT came into use on many crops in 1946, five-year average crop yields covering the periods immediately before and after the introduction of DDT (1941-45 and 1947-51) were compared to determine what if any significant change occurred in per acre yields. Later, to determine production trends, annual per acre yields were converted into terms of per cent of the pre-DDT five-year (1941-45) average. The data thus obtained were exceedingly interesting and while they may not establish exact facts, they are stimulating to say the least. Of course we must recognize that other branches of science have likewise made notable progress and entomology cannot take credit for all gains in production that have occurred since 1946.

Production trends for a number of selected crops on which DDT and other recently developed syn-

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CAPTAN 50-W

(FUNGICIDE 406)

THE EXCEPTIONAL NEW ORGANIC FUNGICIDE FOR FRUITS, VEGETABLES, ORNAMENTALS

Captain 50-W has been thoroughly tested on many crops and has proved to be a superior fungicide that gives better disease control, increased yields, improved quality and longer storage life.

IT IS RECOMMENDED FOR:

APPLE: Scab, Brook's Fruit Spot, Sooty Blotch, Fly Speck, Bitter Rot, Fruit Rots.
PEACH: Brown Rot and Peach Scab.
CHERRY: Leaf Spot and Brown Rot.
AVOCADO AND MANGO: Cercospora Spot or Blotch.
CURCURBITS: Angular Leaf Spot, Anthracnose and Downey Mildew.
TOMATO: Early Blight, Anthracnose Leaf Spot, Septoria, Late Blight, Stemphyllium.
POTATO: Early and Late Blight.
CARROT: Septoria and Cercospora Leaf Spot.
ROSE: Black Spot.
CELERY (Seed Bed): Damping-Off.
SEED TREATMENT: Seed Rots and Damping-Off.
AZALEA CUTTINGS: Damping-Off.

BASED ON GOOD PRELIMINARY TESTS, CAPTAIN 50-W IS RECOMMENDED FOR TRIAL USE ON:

APPLES: Black Rot (Frog Eye)
PEAR: Pear Scab.
PLUMS: Brown Rot.
PRUNES: Brown Rot.
GRAPES: Black Rot and Downey Mildew.
STRAWBERRIES: Fruit Rot, Leaf Spot.
SPINACH: Downey Mildew.
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Experienced operators carefully apply sleeves in the manufacture of sewn-valve bags. Great care is necessary in this operation. An improperly inserted or aligned sleeve can cause sifting after the bag is filled.

DEPEND ON V-C's more than 50 years of bag-making experience to help solve your packaging problems. Long experience, manufacturing skill and top-grade materials, add up to better-built V-C Multiwall Bags that provide maximum protection for your product. V-C Multiwall Bags are designed to your needs, made two- to six-ply, and printed in one to four colors. Write for full information, or discuss your requirements with a V-C representative.

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thetic insecticides are used extensively are presented without extensive comment in Figs. 1-5 (Pg. 39), so that the reader may draw his own conclusions. It may be well to note, however, that in most cases trends are still upward in 1951, the last year for which statistics were available, indicating ultimate yields may still go higher. Alfalfa seed production seems to be a case in point. In many areas the use of insecticides in alfalfa seed production fields has not become a widely accepted practice, and average yields for the nation as a whole have reached only 160 per cent of the pre-DDT level, but in the western states where DDT is used more extensively, increased yields have been phenomenal, ranging up to well over 400 per cent in the state of Washington, where all acreage has received one or more treatments since 1948. It might also be in order to point out that DDT was not used on sweet corn until 1948 and that peak use of insecticides on this crop occurred in 1949 when European corn borer presented a serious threat in the Midwest.

With all of the data presented in Figs. 1 to 5 tending to follow the same trend, one might well wonder whether the increased yields shown were closely related to insecticide usage alone or perhaps equally or more closely related to weather, fertilizer consumption, or some other independent variable. Therefore, data which may shed some light on this subject are presented in Tables 1-3 (Pg. 38). Again, full credit for all increases should not be attributed to insecticide usage alone, but it certainly appears that the obvious correlations between the extent of insecticide usage and the magnitude of increases in yield are not purely coincidental.

The increased yields shown for specific crops on which insecticides have been used extensively since the advent of DDT are enlightening if not indeed shocking to entomologists and laymen alike. Considering only the eight crops for which graphs are presented, we find that combined average yields for the period 1947-51 exceeded those of the previous five years by about 36 per cent, and that maximum yields recorded in 1950 and 1951 exceed pre-DDT averages by over 50%. Even if we claim only half of this increase, the implied losses for 1941-45 would be far in excess of the old 10 per cent guesstimate. Furthermore, it seems highly probable that we are still far from attaining either perfection or the universal use of adequate insect control measures. Therefore, further improvements in insect control might well produce gains equal to or greater than those already attained.

There is an abundance of scattered data to indicate that the control of specific pests on many crops might double, treble, or even quadruple production, as was well illustrated in the case of alfalfa seed production in Washington. There are data on cotton, tobacco, many fruit and vegetable crops, as well as standard cereal and forage crops that indicate increased yields of 25, 50, or even 100 percent frequently accompany effective insect control. We also know that research workers applying insecticides to control some specific pest, for example, the European corn borer, often obtain increased yields far in excess of any reasonable expectation. This no doubt is due to the control of minor pests that were unnoticed and completely overlooked. In view of these facts, it appears that the statistical data presented above must be accepted and studied with something more than skepticism.

Over the years, with some degree of hesitation we have estimated insect losses at 10 per cent of all agricultural production, but in the light of new evidence we can now guess they may approach or even exceed twice that value.

Thus far we have considered only agricultural losses, but insects do not confine their activities to field crops or rural areas—they are truly ubiquitous and occur in almost every conceivable habitat. Mosquitoes, ticks, fleas, lice, and flies attack man himself, spreading diseases which take an inestimable toll of human comfort, human energy, and even life itself. Termites and other wood infesting insects destroy furniture, homes, other structures, and wooden products in general. Clothes moths and related pests destroy clothing, furs, rugs, upholstered furniture, and practically all types of fabric. Stored product pests damage grain, cereal products, candy, nuts, dried fruits, spices, tobacco, and many other products. A variety of pests destroy our forests, shade trees, lawns, and ornamental plantings, and last but not least, a multitude of nuisance pests, ants, roaches, flies, and mosquitoes, invade our homes, causing the housewife no end of anxiety and grief. No attempt will be made here to estimate the magnitude of such intangible damage or losses, except to say that such damage may be counted in the millions of dollars annually. It is perhaps significant that housewives each year purchase upwards of $100 million worth of the so-called household type insecticides, and perhaps an even greater sum is paid out annually for the services of pest control operators. Considering the whole problem in all of its many phases, it would appear safe to estimate over-all insect losses in the United States at a figure somewhat in excess of 10 billion dollars annually, and when human health and life are considered, there are those who would materially increase such a figure.

Outlook On Insect Control

HAVING reviewed in some detail the past and present potentialities of the insect world, we return to the assigned topic, "The Role of Insects in the Economic Future of Man." It seems safe to assume that insects will continue to harrass the human race until the end of time. Man may never completely exterminate a single species, though he undoubtedly will eradicate many pests in limited or even large areas.

There seems to be little question but what insects will continue to demand tribute of enormous proportions which will have to be paid in terms of insect damage, pain and suffering, or expenditures for insect control. Man may, through judicious expenditures for research and practical insect control measures, reduce or

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minimize the tribute to be paid, but he can never eliminate it entirely. In this connection, it should again be noted that entomology is not static. Insects, as highly versatile living organisms are constantly changing to meet each change in the environment, whether it be biological, physical, or chemical. Therefore, if we are to hold our own in this continuing battle, research must continue undiminished, and if we are to make progress, research must be expanded.

At the moment we appear to be losing ground. When the Bureau of Entomology and Plant Quarantine was organized into its present structure in 1934, it received an appropriation of $1,867,215 for research. In 1953 this same bureau received $3,888,760, or approximately double the amount received 20 years before. In the meantime, however, the buying power of the dollar had dropped to about ⅓ its 1934 level, and thus in reality entomological research at the federal level is not so well supported today as it was 20 years ago. The same conditions prevail in most states. In this same period gross farm income jumped from approximately $8 billion to nearly $40 billion, and on this basis entomology can provide less than one-half the service formerly rendered.

Medical entomology seems to be in a favorable position, and continued progress seems almost assured. Within the past decade, DDT and a number of equally remarkable insecticides have proved to be so effective in controlling the many disseminators of insect-borne diseases of the past that man's battle for survival may now have been won, and from this point on our conflict with the insect world may be purely an economic war. While we hope this is the case, we must be mindful that we are dealing with three biological entities—the insect, the disease organism, and the host—all of which have potentialities for variation, and that any one or all of them may develop a tolerance for chemicals now in use which could set us right back where we were twenty years ago. Let us recall that many disease organisms no longer respond to antibiotics and other drugs once considered infallible, and that even now house flies, mosquitoes, lice, and a number of other pests have shown definite resistance to DDT and several other insecticides.

Household pests are currently reasonably well under control, yet there is no evidence that we have exterminated or even completely eradicated any of them from any large area. The continued use of millions of dollars worth of household insecticides annually will no doubt be necessary to maintain the status quo, and there is imminent danger that one or more pests now suppressed may, by developing resistance to a number of chemicals, attain the upper hand and at least temporarily run out of control.

Economics of Insect Control

MUCH progress has been made in the agricultural field, but with current insect losses estimated at somewhere between four and eight billion dollars annually, there is obviously much room for improvement. It would appear safe to estimate that insect damage to crops and animals could and can be reduced by 50 per cent, which would be equivalent to increasing agricultural production by about 2 to 4 billion dollars annually.

Of course there are those who will insist we cannot afford the added cost of insect control or that we dare

It pays to pamper crops!

The farmer appreciates the value of scientific pest control, for he can thus raise more crops per acre and yield a greater profit. And progressive formulators, too, realize this growing market demands better chemicals to produce effective herbicides. For these, as well as for insecticides, Neville makes two grades of Solvents that are proving highly popular in this field.

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	NEVSOLV 200	NEVSOLV 30
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Specific Gravity	.890 to .915	.835 to .845
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not add to our overhead cost. Such assertions are economically unsound. The overhead charges associated with the planting, cultivating, and harvesting of each acre of crops are fixed, and if one can increase yields sufficiently to provide a cash return of two, four, eight, or more times the cost of treatment, those extra pounds, bushels, or tons are produced much more cheaply than the rest of the crop and they thereby increase net profits and have the effect of reducing operating costs.

Some will argue that increased yields mean overproduction and lower prices. This we may in part concede, but bear in mind that the same argument applies to every new technological development. The answer is clear. For years we have been attaining production goals by mining the soil—in other words, by robbing generations yet unborn of their birthright. This practice is both economically and morally unsound. Good economics, sociology, and morality demand that we produce maximum yields as efficiently as possible on a minimum number of acres and the surplus land should be removed from cultivation and devoted to soil building practices until such time as it is sorely needed to meet the production requirements of an expanding population.

Aside from the matter of crop savings and crop losses, insect control or the lack thereof may have an indirect bearing on several economic and sociological considerations. Maximum utilization of insect control measures might in effect retire upwards of 100 million acres of land from cultivation or release it for new uses, and a million or more farm laborers might conceivably be displaced.

Then, too, the presence or absence of certain insect problems may often determine the success or failure of certain agricultural enterprises. Radical changes in the status of certain insect problems may induce serious local or even regional adjustments in our agricultural system. For example, the boll weevil so affected the cotton industry that it brought about diversified farming in the Cotton Belt. Later, effective control of

the cattle fever tick and the screwworm paved the way for an expansion of the livestock enterprise in this same area. Now there is every reason to believe that the South will soon develop suitable measures for controlling the insect pests of growing and stored corn, in which case the development of a corn enterprise would seem almost inevitable.

In the last five years alfalfa seed production has largely shifted from the Mississippi Valley and Great Plains areas to the Pacific Coast states. Also, alfalfa seed production in the United States has practically doubled in the last 10 years, and alfalfa seed imports dropped from 20 million pounds in 1948 to less than 6 million pounds in 1951. Some will laud the decrease in imports as a six million dollar gain for the American farmer, while others will complain that we are upsetting the balance of foreign trade.

After noting these minor adjustments in the distribution of agricultural enterprises in this country one may well speculate as to what will happen when and if man succeeds in suppressing insects in the tropics where potential agricultural production of a high but unknown magnitude remains undeveloped largely because insects to date have defied man's attempts to invade this area over which they claim eminent domain.

One might note also that recent developments in insect control through the use of insecticides have given birth to a new chemical industry. The production of synthetic organic insecticides jumped from something less than two million pounds in 1943 to over 200 million pounds in 1951, and it seems quite probable that this industry will have ample opportunities for continued growth.

If the American concept of the economics of insect control could be extended to include other areas of the world, some of which still employ very primitive agricultural methods, potential increases in the production of food, feed, and fiber at the moment defy estimation. In many areas such increases might mean the difference between marginal existence and an adequate standard of living for millions of people.

It seems fully evident that the role of insects in the economic future of man will be a continuing one. The degree of success already attained in combating insects should make us even more keenly aware of work still to be done. We dare not rest on our laurels; rather, we must be continually alert to the potentialities of our insect enemies and take advantage of every means at our disposal to reduce their damage.

Let us hope that the evidence presented justifies the conclusion that insects, far more than we have ever suspected, have affected human economy. Is it not conceivable that the current upward trend in agricultural production, a large share of which must be due to insect control, will continue for some time before another plateau is reached? There has never been a time when entomologists could take such justifiable pride in their accomplishments as they now can. It is difficult to predict weather. It is difficult to predict election results. It is most difficult to predict economics. But in the light of present known facts we can predict with assurance that—given adequate support—entomology can play a major part in enhancing the future welfare of humanity.

Everyone seems to be clamoring for tax reduction, and experts insist tax reduction would strengthen our national economy. Conservatively estimated, insects impose a tax on agricultural production in excess of four billion dollars annually, which is four times the total taxes paid by the farmers of this country on real estate and personal property. The insect tax may easily be cut in half but not by wishful thinking. In the last analysis, therefore, the question is not what are insects going to do to our economy, but what are we going to do about insects?★★

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HERBICIDE STUDIES

(*From Page 47*)

stage when we can predict the effect of a given chemical structure upon a given cellular component, it is necessary to rely upon empirical evaluations to find our most potent agricultural chemicals. If the gap between investigations on isolated biological systems and studies on intact higher plants can be narrowed it is not unlikely that, besides synthesizing chemicals to kill weeds, fungi, and insects, it will be possible to regulate plant growth from germination to flowering. This goal will be achieved only through the proper balance between basic cell research and applied agricultural investigations.★★

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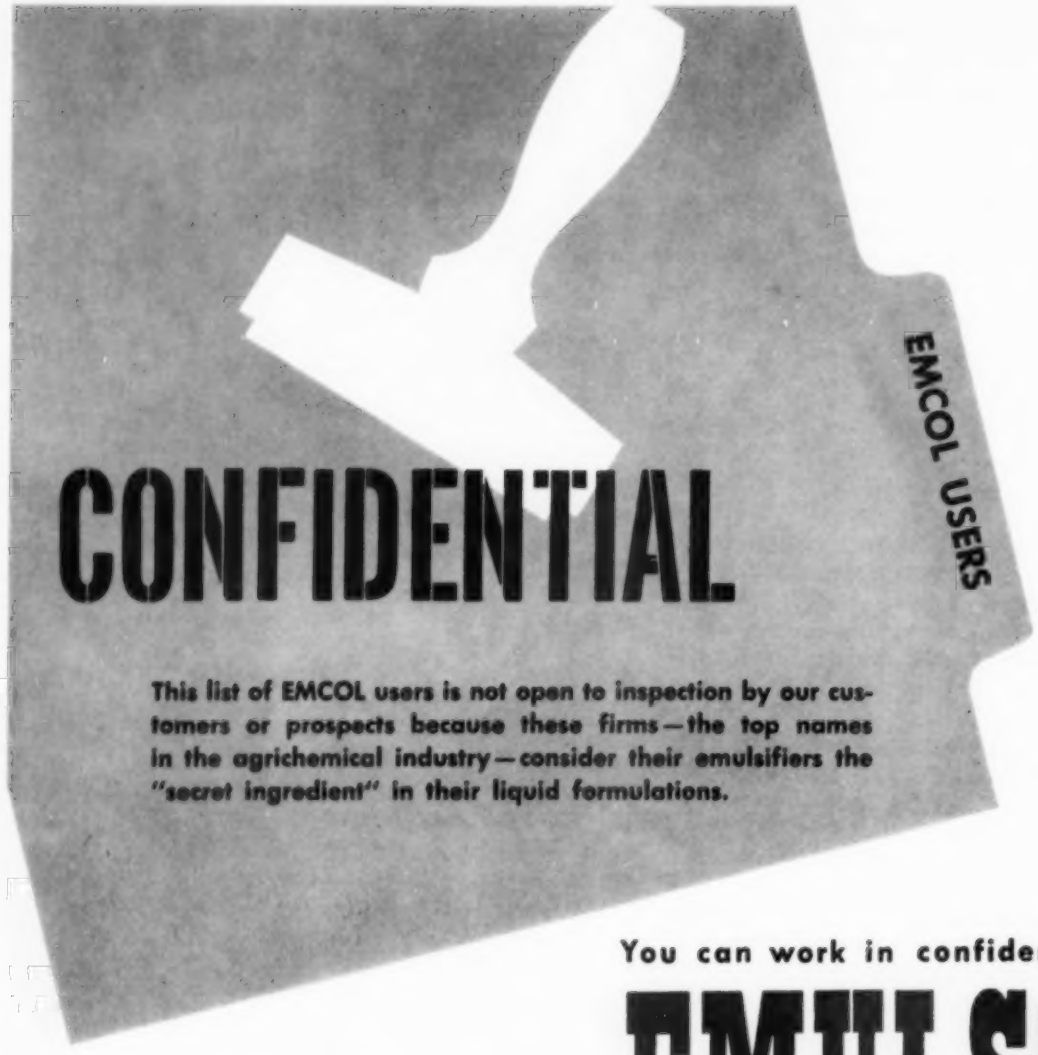
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ISOTOPE STUDIES

(*From Page 54*)

directly to the amount of toxicant taken up by the spores rather than to the concentration of the external solution. These results emphasize the importance of determining dosage on a spore weight basis whenever possible. When different chemicals are compared as to their effectiveness on the basis of the concentration of the applied solution, no distinction is possible between differences in degree of accumulation and innate toxicity. In a screening program there may thus be a tendency to favor chemicals which are accumulated by the spores and to overlook chemicals which may be innately more toxic but which are being compared to their disadvantage

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with chemicals that are accumulated to a great degree.

Recent results obtained by Barnes and Greathouse (1) with C^{14} labeled 8-hydroxyquinoline and the corresponding 1:1 and 2:1 copper chelates are of interest in this connection. They found that, with the non-chelated material, spores of *Aspergillus niger* took up 100,000 times as much as an equal weight of mycelium. When the chelates were used, the mycelium took up as much as the spores.

Inasmuch as the toxic doses thus far found are many fold higher than those of the more effective toxicants for bacteria, insects, and mammals, it may be postulated that the really effective fungicides are still to be found.

We have given only a few examples of the kind of studies that can be carried out on fungicides using radioactive tracers. Only a beginning has been made of what is possible with this new technique. Meanwhile, isotopes are also being used to gain a better understanding of the physiology of fungus spores. As advances are made in understanding the basic processes taking place in fungus spores and the effect of fungicides on these vital processes, one may look forward to a better understanding of how fungicides act and thus may be able to obtain better fungicides.★★

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FERTILIZER RESEARCH

(*From Page 50*)

as a possible means of preparing sulfuric acid and agricultural lime. Mixed fertilizers are also receiving attention, and improved processes for their preparation are being studied.

The fertilizer manufacturing research program has been largely sponsored and financed by the Engineering Experiment Station of the College with state appropriated funds.

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However, support from industry has also been forthcoming. For example, the superphosphate quick curing program has been assisted very materially by the Link-Belt Company of Chicago through loan of most of the small scale and pilot plant equipment and by advice and assistance in the operation of this equipment. Also a graduate fellowship for work in fertilizer technology was recently established by the Rauh-Martinet Foundation of Indianapolis. Needless to say, additional assistance of this kind would be welcomed by the College to expand the research program further.

One of the important benefits of the program, in addition to the technical information derived, is the training of chemical engineers in fertilizer technology. A number of the Iowa State chemical engineering graduates of recent years have gone into responsible positions in the fertilizer and related industries. Among them are Dr. E. C. Kapusta of the National Fertilizer Association, Dr. George Burnet of Commercial Solvents Corporation, Dr. E. H. Brunsting of Vulcan Copper and Supply Company, and Dr. J. W. Markey of the Tennessee Corporation. Although the graduate program taken by these students is not designed to make specialists of them in any one field, but rather to give them a broad training in chemical engineering, many of the graduates have gone into the fertilizer field after graduation.

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INS-FERT MIXTURES

(*From Page 44*)

alone. Compton(1) had previously noticed a similar effect with chlordane, and attributed it to increased root vigor due to the control of minor soil pests. The insecticides which are now being recommended for use in fertilizers have been tested thoroughly in such mixtures, and have been accepted for registration by regulatory agencies only after having been proved safe for use. Each mixture involving a new insecticide will have to be similarly tested and proved safe before reaching the marketing stage.

The increasing acceptance of insecticide-fertilizer mixtures is evidence that they are proving economically effective for control of insects in the soil. The practicability of such combinations has been fully demonstrated, although a number of problems relating to their manufacture and storage remain to be solved. It is expected that experiments now

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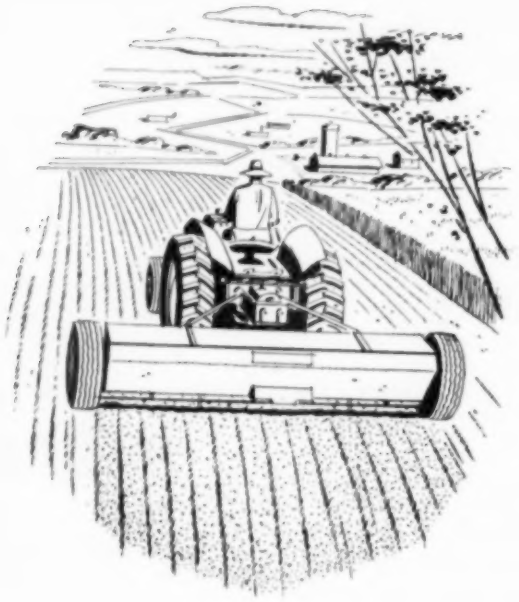

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in progress and the practical experience being gained by fertilizer manufacturers will provide the needed answers, and will aid the industry to meet the growing demand in this interesting new field.

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FUNGICIDE TESTS

(*From Page 62*)

with portable sprayer in a test begun in the growing season of 1952 and carried through the storage season of 1952-1953. "Season was not bad for fruit rot, but indications are similar to last year indicating that the fungicide must be present at extended rain periods to prevent latent infections from becoming established."

			DC	
Unsprayed Checks			1.5%	rot
Zerlate	1½/100	Sprayed to July	0.9%	rot
Zerlate	1½/100	Sprayed July to Harvest	1.03%	rot
Zerlate	1½/100	Sprayed Calyx to Harvest	0.8%	rot

Apple (Jonathan)

Powdery mildew (*Podosphaera leucotricha*) Wenatchee, Washington. Roderick Sprague. Seven applications of spray, beginning with pre-pink, were applied between April 1 and May 28 with stationary spray equipment. "Karathane would be our first choice if it were available. We now recommend lime sulfur or polysulfide at the pre-pink and pink followed by wettable sulfur and first cover sprays. In our desert country we always run the risk of injury from late sulfur applications. On Winesaps we dust with sulfur only and before bloom; on Golden Delicious we have no trouble before bloom but do not apply calyx or cover sprays on these. None of the following were effective: Ethyl B622W, Stauffer N244 and N521, Crag 658, Ovotran, Penn Salt 1409W-50, Streptomycin sulfate (10 ppm), Rohm & Haas 765, Penn Salt NP770E30. Lithium chloride and lithium sulfate caused severe injury on young trees. Merculine ½ pint and 1 pint, Cuprosil 1 qt., Mercusan 1 qt., Fermulene 1 pt., all were either feeble fungicides or caused leaf marginal burning. On apple scab the best summer spray was Captan (2-100), but if concentrated injury resulted. Streptomycin sulfate at 10 ppm was not effective against fire-blight on pears."

	Amt./100 gal.		DC	PS	Y	OP
Karathane	1 lb.	5 sprays	1	1	1	1
Liquid L.S.	3 gal.-2.5 gal.	pre-pink, pink, calyx	2	2	2	2
Colsul	3 lb.	4 sprays	2	2	2	2
Polysulfide Comp.	2.5-3 lbs.	3 sprays	2	4	3	2
Phygon	½-1¼ lbs.	4 sprays	3	2	3	-
Wettable Sulfur	3 lbs. lime Sulfur after	1-2 sprays	2	5	-	2

Apples

Rust (*Gymnosporangium juniperi virginianae*). Pennsylvania. Fred H. Lewis. The materials listed in the next table (page 129) were rated on Golden Delicious.

"Ferbam was the only material that gave rust control in all of our tests. Neither Crag 341-mercury nor Captan gave a sufficiently higher degree of control to be depended upon where rust is a real problem."

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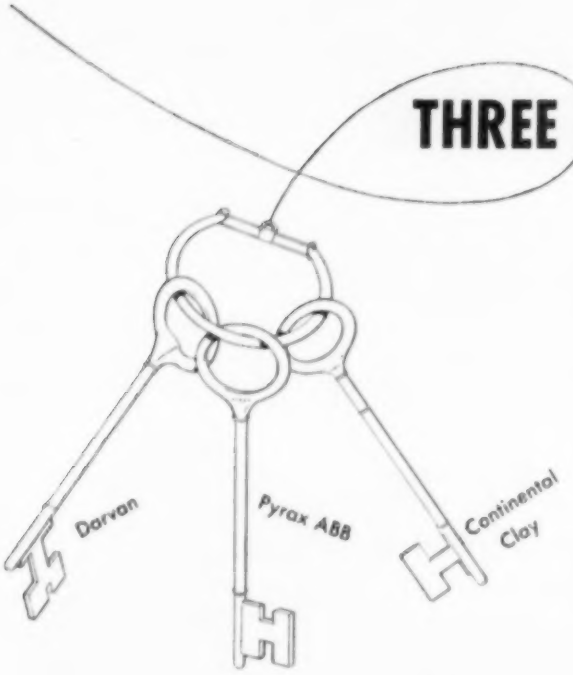

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Pyrax ABB is nonhygroscopic. It may be stored from season to season because it does not affect the toxic strength of DDT, rotenone, pyrethrum, toxaphene, benzene hexachloride, the thiocarbamates, or the newer organic toxicants. Pyrax ABB is chemically inert — pH between 6.5 and 7.0. Free flowing, it mixes quickly and homogeneously giving a more even feed from the hopper, even with the newer waxy and oily toxicants. Pyrax ABB is extremely well adapted for aircraft dusting.

Non-drifting, Pyrax ABB produces a dense cloud that hugs the crop and adheres electrostatically — even to the dry underside of foliage — insuring less waste and permitting effective daytime dusting.

Increased plant capacity now assures an adequate supply of Pyrax ABB.

Darvan #1 and #2

Excellent dispersing and suspending agents for agricultural wettable concentrates. The unusual qualities of the Darvans maintain finely divided solids or liquids dispersed in aqueous medium over long periods of time.

Darvans are soluble in water, with a neutral pH, and stable toward mild acids and alkalis. Characteristically, Darvans break up agglomerates or flocs to their ultimate particle size to produce better dispersions.

Recent tests indicate that very small amounts of Darvan actually increase the effectiveness of toxicant in wettable concentrates. Field tests showed greater crop yields when Darvan was added to the active agent and carrier than when the same carrier and agent were used without Darvan. The addition of Darvan with a wetting agent also increased the yield.

Continental Clay

Continental Clay is recommended as a highly compatible and non-alkaline carrier for your agricultural high bulk dust. Continental is further recommended for wettable concentrates.

For both High Bulk Dusts and Wettable Concentrates, Continental Clay is an economical, top quality carrier of unusually fine particle size (0.8 micron by air permeation and less than 0.75% retention on a 200 mesh screen). Continental is a non-abrasive, extremely flowable carrier for high bulk dust. In wettable concentrates, it is outstanding in qualities of dispersibility and wettability. Continental Clay assures uniformity for all your dry dusts and wettable concentrates. Continental Clay is always available in adequate supply.

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- ☐ Please send sample of DARVAN.
- ☐ Please send sample of CONTINENTAL CLAY.

NAME _____

POSITION _____

(Please attach to, or write on, your company letterhead)

Treatment	Rust on Leaves 200 Spurs	% Severe Fruit Russet
Ferbam—EPN	6	50.5
Ferbam-carbon—EPN	1	63.5
Ferbam-phygon—EPN	2	40.0
Sulfur-ferbam-lead arsenate	8	17.0
Crag 341-lead arsenate	89	12.0
Crag 341-lead-high pressure gun sprayed	66	36.5
Crag 341-mercury-lead arsenate	85	17.0
Crag 341-mercury—EPN	415	35.5
Crag 341-mercury-parathion	163	41.0
Crag 341-Coromerc—EPN	186	72.0
Captan—EPN	279	10.5
Captan-Coromere—EPN	265	30.5
Puratized Agr. spray—EPN	262	38.5
Coromere—EPN	723	39.0

failed to prevent rapid spread of scab on both foliage and fruit. Captan has always done well so long as spraying started before the first infection of the season. Excellent eradication was obtained with Crag 341-mercury and with lime sulfur at 6 qts."

Field and Forage Crops

Tobacco

Blue Mold *(Peronospora tabacina)* control in plant bed by F. A Todd and C. J. Nusbaum, Whiteville, North Carolina. Eight applications of following fungicides with small power sprayer were made during March and April twice each week. Total of 30 gallons per 100 sq. yards. All treatments gave good control except Thiolutin. None caused any injury. The first three materials in the list are given over-all preference.

		DC
Dithane Z78	2—100 g.	1
Parzate	2— "	1
Manzate	½ "	1
Fermate	4— "	2
Vancide	2— "	
Thiolutin	9 grams	No control

Blue Mold control, by dust fungicides in comparison with sprays, were carried on by Q. L. Holdeman at the Pee Dee Experiment Station, Florence, South Carolina. All materials, except Thiolutin, were of equal value as to disease control, plant safety, and over-all preference. Standard recommendations heretofore included Fermate, Dithane and Parzate.

Sprays			OP
Fermate	4# /100 gal.	3-6 gal./100 sq. yd.*	1
Dithane Z78	3# "	"	1
Parzate	3# "	"	1
Vancide F956	3# "	"	1
Vancide F956	4# "	"	1
Vancide F956	5# "	"	1
Thiolutin	120 PPm	"	4
Dusts			
Fermate	15%	1#—3#/100 sq. yds.	
Parzate	10%	"	
Dithane Z78	10%	"	
Vancide 956	15%	"	
Thiolutin	60 PPm	"	

*Rate increases as plants grow.

Blue Mold control experiments at Quincy, Florida, in plants bed, with a plunger duster, were conducted by R. R. Kincaid. Three applications a week were made for 5 weeks, at the rate of 15-35 pounds per acre per application. No plant injury was observed. All gave satisfactory disease control, except Thiolutin. Yields and over-all preference are based on number and quality of seedlings obtained for transplanting.

		Y	OP
Dithane Z78	6⅔% in Tobacco diluent	1	1
Dithane Z78	19½% active in Pyrax	1	
Thiolutin	62 PPm in Tobacco diluent	1	
Parzate	6⅔% active in Pyrax	2	2
Parzate	19½% " " "	2	
Parzate	6⅔% " Tob. diluent	2	2
LO-738	7½% " Pyrax	2	
Thiolutin	180 PPM Tob. diluent	2	
Fermate	15% active in Pyrax	3	
Dithane Z78	6⅔% " " "	3	3
No. 5460	7½% " " "	3	
Iron Vancide	7½% " " "	3	

Potatoes (Pontiac)

Early blight *(Alternaria solani)*. Bridgeville, Delaware. J. W. Heuberger. Field plots were sprayed 6 times with 125-175 gallons per acre, using power sprayer, and the following materials were rated, being given in the order of disease control and over-all preference. The new organic B622 was "outstanding in its control, but caused slight yellowing of the foliage."

		DC	PS	Y	OP
Dithane Z 78	2	1	1	2	1
Parzate	2	1	1	1	1
Manzate	1½	1	1	1	1
B-622	3	1	2	1	1
Bordeaux	6-3	2	2	3	2
Tribasic	3	2	2	2	2
Robertson	.. 1.7	2	2	2	2
Untreated	3	—	—	4	3

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. . . there are several starting points for its many uses and users

"What shall we use?" This question always confronts management when it is considering raw materials to be used in operating processes, and is not always easy to decide.

In the manufacture of sulphuric acid, the use of sulphur in some form is mandatory, whether it be elemental sulphur or sulphur in combination with other elements. No single factor can determine which raw material should be used. Relative supply situation, cost of transportation, cost of plant and cost of use are all considered by management.

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Potatoes (Bliss Triumph)

Late blight *(Phytophthora infestans)*. Homestead, Florida. George D. Ruehle. Field plots, replicated 4 times, were sprayed 9 times between December 22 and February 17. Parathion used in two applications. Late blight was the only disease of any consequence.

lbs.-100 gal.	Mean Defoliation %	Bushels U. S. No. 1		Increase over check	OP
Check	—	100	217	—	1
(LO 765) 60% WP	2	90	239	22	1
	4	74	270	53	1
(LO 765) 60% WP	3	26	289	72	1
	2 qts.—1	23	286	69	1
B-622 (50% WP)	2 qts.—¾	7	317	100	1
	1.5 lbs.—5 times				
Nabam + Teehmangam					
Nabam + $ZnSO_4$	2.0 lbs.—5 times	6	329	112	1
Zineb	4 lbs.—½	6	329	112	1
Cop-o-zinc + Phygon	2	9	330	113	1
E bis thiuram	4—4 times				
Captan (50% WP)	2 2/3—				
(75% WP)	6 times	10	337	120	1

L.S.D. at 5% level 29 bu.
L.S.D. at 1% level 39 bu.

Potatoes (Green Mountain)

Late blight *(Phytophthora infestans)*. Durham, New Hampshire. A. E. Rich, J. D. Bilbruck and H. V. Toko. Small field plots sprayed 10 times with hand sprayer at weekly intervals.

	lb.-100 g.	DC	Y	OP
Manzate	2	1	1	1
Dithane + $ZnSO_4$	2 qt. + ¾	2	1	2
Phygon	¾	3	2	
Captan	2	4	3	
COCS	3	4	6	
Ethyl B-622	2	5	5	
Vancide 51ZW	2	6	4	
Bordeaux	8-4-100	7	7	

Potatoes (Bliss Triumph)

Seed piece decay. Homestead, Fla. G. D. Ruehle. In a non-replicated comparison of Captan dust with formaldehyde dust the following results were secured. "The stand was practically identical with the 2 dust treatments but a difference of 59 bushels in favor of the Captan was obtained."

Treatment	Percentage Stand 400 seed-pieces	Yield in bushels per acre
Check—cut and planted at once	95.0	379
Formaldehyde dust	98.5	357
Captan dust	98.8	416

Potatoes (Bliss Triumph)

Seed piece decay. Homestead, Fla. G. D. Ruehle. In small field plot each containing 100 seed pieces and replicated 4 times, the following treatments were compared. "Indications are that Captan might fill the need for a quickly applied, effective and economical seed piece treatment. It gave nearly perfect control and the highest yield of No. 1 tubers. Surface scurf and netting caused by Rhizoctonia was appreciably less on tubers from Captan dust treatment plots, and to a lesser extent from the Captan dip treatment plots."

Results of replicated seed treatment trial with cut seed of Bliss Triumph potatoes, 1952-1953.

(Conclusion in March)

Treatment of cut tubers			Percentage Stand	Yield, bu. per A.	
Material	Formula	Time	Avg. of 4 replicates	U. S. No. 1	Increase over check
None—	Check cut and plant	—	82.5	302	—
None	suberize	48 hrs.	98.75	366	64
Phygon XL	1 lb.-100 g.	1 min.	94.25	331	29
Captan (50% w)	4 lb. " "	1 min.	95.25	358	56
Captan (50% w)	dust seed	—	99.5	381	79
Semesan-Bel	1 lb.-7½ g.	1 min.	99.-	3.4	52

L.S.D. at 1% level 43.4 bu. L.S.D. at 5% level 31.4 bu.

GARDEN SHOW

(From Page 51)

Pest" rose dust in a 10 oz. gun or a 3 lb. package, and announced that "End-O-Pest Arc," formerly available only in liquid form, is now marketed in dust form, in a 1-lb. shaker package and a 4 lb. bag. "Arc," it was explained, is a coined word from the initial letters of three lawn pests, ants, roaches and chiggers, which the product controls. Other items in the huge mass display of Swift garden chemicals included "Vigoro" complete plant food, available in 10, 25, 50 and 100 lb. packages; also "Instant Vigoro" in water soluble form, in ½, 1 and 3 lb. containers; "End-O-Pest" water soluble tree spray in 1 and 3 lb. cans.

California Spray Chemical Corp., Richmond, Calif., showed their full line of home and garden chemicals now nationally advertised in six magazines and 157 newspapers. Three new products included "Ortho Malathion 50" spray, for evergreens, shrubs and other ornamentals; "Ortho-Gro" dry fertilizer for flowers, vegetables, lawns, etc.; and a versatile "Orthocide" garden fungicide. In addition "Isotox" garden spray, which originally contained only lindane, is now reported to contain Malathion and DDD, for wider insect control.

Rose Mfg. Co., Beacon, N.Y. displayed three new products — Kill-Ogen" aerosol bomb for indoor or outdoor plant insect control; "Tri-Ogen," a 10 oz. refillable dust gun; and Tri-Ogen plant food spray for foliar feeding. Shown, too, was the

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Handbook of Agricultural Pest Control

by S. F. Bailey and L. M. Smith

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A practical handbook for the custom spray operator, the pest control operator, farm advisor, agricultural chemical salesman and field worker. This handbook covers the agricultural chemicals (insecticides, fungicides, herbicides, plant hormones and nutrient sprays, defoliants, etc.), their rates of application, useful formulas, as well as chapters on fumigation, spray machines, toxicology, dusts and dusting, aircraft, and mosquito control.

The book is pocket sized (5 x 7¼ x ½ inches), bound with a flexible leatheroid cover, for convenient, practical use. It includes more than 100 tables for practical everyday use. Conversion formulas and examples illustrate application to specific uses.

Insect Control by Chemicals

by A. W. A. Brown

817 pages, price $12.50

817 pages. This text traces the relation between molecular structure and toxicity; classifies the insecticides and gives their chemical, physical properties; discusses the hazards to avoid in formulation, mixing and use of compounds; and illustrates modern application equipment, including nozzles; sprayers, blowers, etc;

The Chemistry and Action of Insecticides

by H. E. Shepard

504 pages, price $7.00

This new book gives a vast wealth of information on insecticides—their chemical, physical, and toxicological aspects. Helps the chemist determine their important applications and their effects upon insects. Gives history, commercial importance, major uses.

Covers these chemical groups: Arsenical Compounds; Fluorine Compounds, Sulphur Compounds; Copper Compounds; Inorganic Substances; Nicotine; Rotenone; Petroleum, Soaps, Creosotes; Synthetic Organic Insecticides. ...

Destructive and Useful Insects Their Habits and Control

by C. L. Metcalf and W. P. Flint

1071 pages, price $10.00

This authoritative guidebook covers hundreds of both useful and destructive insects—treating the inner and outer structure and form of general species—explaining their eating and breeding patterns, and life cycles—telling you how to recognize them in any stage of development.

Here are descriptions of more than 500 types of insect pests of the U. S. and Southern Canada. The insects are grouped in accordance with the crops, animals, or products they attack. For each insect you are given recognition marks and types of injury it does to man—enabling you to determine exactly *what* insect is damaging your crop, and supplying you with the most effective means of dealing with it.

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- ☐ Insect Control by Chemicals—$12.50
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- ☐ Destructive and Useful Insects—$10.00

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full line of garden chemicals and a kit which includes plant food and insecticides for African violet culture.

B. G. Pratt Co., Hackensack, N. J., which is this year observing its 50th anniversary, introduced five new products, — a weed killer with sodium arsenite for termite control; a rose and flower aerosol spray with pyrenone base; a half-pound rotenone garden dust gun for vegetables and roses; and DX aero spray for African violet treatment. Speaking of the company's half century of service, Henry B. Pratt, vice president, recalled that the original Pratt product, Pratt's "Scalacide," was the first dormant spray to be made commercially. The company's history since then, he said, is practically a complete epitome of the growth of the garden and household chemical supply industry.

Niagara Chemical div., Food, Machinery and Chemical Corp., Middleport, N. Y., introduced a new brush killer and a new push and pull dust gun for application of "Pomogreen" insecticide. Also available now is a Malathion 50 percent spray in 4 oz. and 1 pint cans.

Acme Quality Paints, Inc., insecticide dept., Detroit, introduced a new all-round dust bomb, also a new Malathion 50 percent spray for garden insect, fly and mosquito control, together with the full line of home and garden chemicals.

Black Leaf Products div., Virginia-Carolina Chemicals Co., Richmond, Va., introduced a new 1-lb. package of granular dieldrin for control of lawn and turf insects and Japanese beetles. Shown, too, was a new display rack with an assortment of garden chemicals most frequently in demand, intended to stimulate sales at the retail level.

American Chemical Paint Co., Ambler, Pa., had a new seed protectant, "Seed-Tone," and showed a refillable rose and floral dust gun which has been redesigned with 8 oz. magazine for offering at a popular price.

Kahn Bros. Co., Chicago, presented the "Mend-A-Lawn" combination lawn fertilizer and grass seed package, referred to earlier, which has been on the market about nine months. Other exhibitors noted at the Chicago show, and some of the products shown included:

Nott Mfg. Co., Mt. Vernon, N. Y., rodenticides, herbicides, repellents, soil conditioners, plant food, insecticides.

American Bildrok Co., Chicago, "Top Soil" and soil conditioner. Zonolite Co., Chicago, terra-lite vermiculite for plant propagation. Magma Corp., Chicago, Magnite fertilizer and soil conditioner. Stim-U-Plant Labs., Columbus, O., Special plant foods and potting soil for African violets, roses, etc. Milligan Bros. System, Jefferson, Ia., "Plant Plate," wettable foliar spray concentrate, composed of urea fertilizer, with insecticide and fungicide and a sticker which prevents the product from being washed off outdoor plants. Armour Fertilizer Works, Atlanta, Ga., Armour's "Vertagreen" fertilizer in consumer packages.

Nutritional Concentrates, Inc., New Lexington, O. Balanced soluble plant food in tablet form with feeding device. Bonide Chemicals Co., Utica, N. Y. Insecticides, fungicides, etc. for home gardens, lawns, paths, drives, etc., and for household use. Garden Products Co., St. Louis. Insecticides, weed killers, liquid fertilizer, in small packages, mole killer, etc. Heller-Gro, Colorado Springs, Colo. Complete plant food in liquid or soluble paste form. Distributed in western states since 1939. Development of the paste form in a polyethylene tube permitted expansion of sales territory east of the Mississippi in 1953. Science Products Co., Chiago, developer of the "seedless tomato" showed plant hormones, plant food and insecticides.

N.E. WEED MEETING

(*From Page 41*)

trolling weeds. They are safe when applied pre-emergence, even with severe leaching. Considering both ideal and extreme soil moisture conditions, the NaPCP formulation AC-P195A was found to be an outstanding material whether applied pre- or

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- *Protects consumers of food by limiting the amount of pesticides which can appear on farm produce*
- *Limits the time for FDA to establish pesticidal residue tolerances*
- *Provides standards upon which directions for use can be based*
- *Aids growers by establishing guideposts to follow in using pesticides*

*This is the new Miller Bill substitute for H.R. 4277 of the last session of Congress. It retains the principles of H.R. 4277 with some changes in technical phraseology and procedures for establishing tolerances. We urge all those interested in public health and agriculture to support this bill through their Congressmen. For details write the Executive Secretary.

NATIONAL AGRICULTURAL CHEMICALS ASSOCIATION

910 SEVENTEENTH STREET, N. W. WASHINGTON 6, D. C.

post- emergence, both for its weed killing properties and for its lack of crop damage. PCP on the other hand gave dissappointing weed control. The ethyl sulfate derivatives of 2,4-D gave weed control comparable to 2,4-D when used at sufficiently high rates. "Dalapon" was harmful to the corn and gave poor broadleaved weed control. It gave excellent control of the few grasses present. Mr. Sweet indicated that soil type and crop variety were relatively unimportant in influencing crop response to herbicides.

According to D. Y. Perkins, Cornell Univ., Ithaca, chloro-IPC is the most promising post-emergence herbicide for muck-grown onions of western New York. He also indicated that this compound causes little damage to the plant. "Sinox PE" is reported to be very successful in pre-emergence treatment of peas, according to E. R. Marshall and L. E. Curtis, G.L.F., Ithaca. "Natrin" is somewhat superior to "Crag," although both give good weed control in tomato fields, according to R. M. Menges and R. J. Aldrich, USDA, Rutgers Univ., New Brunswick, N. J.

Crabgrass control discussed by J. A. deFrance and S. W. Hart, Rhode Island Agri. Exp. Sta., Kingston, R. I., may be achieved by use of phenyl mercuric acetate. They indicated that most effective control is obtained on plots receiving a high rate of nitrogen fertilization, and normal rate of "Scutl."

A series of reports dealing with an effective weed control program, importance of state weed and seed laws, cooperation of research and extension in a weed program, farmer interest, etc, were presented by A. O. Kuhn, Univ. of Maryland, College Park; E. P. Sylwester, Univ. of Iowa, Ames; N. J. Smith, Madison County, N. Y.; E. Deen, Univ. of Kentucky; and C. E. Phillips, Univ. of Delaware. Recognition of weeds, correct equipment, intelligent application of chemicals, education etc, were among the phases considered.

Still another phase in the weed control conference was a session on the significance of weeds in public health, and weed control along roads and highways.

The final session of the meeting summarized the results presented by the research coordinating committee. Their report reviewed overall coverage of weed control methods in general use, those which are ready for field trial and those which are still in the experimental stage. Future research needs were also outlined. It was stressed that the rates, methods, etc, presented by the committee were not recommendations for general local use, but merely a guide for trials to establish local use.

Committee members for 1954 were announced by A. O. Kuhn, newly elected president. These are as follows:

Program, W. W. Smith, Univ. of New Hampshire; Coordinating, L. L. Danielson, Virginia Truck Exp. Sta., Norfolk; Publications, R. J. Aldrich, Rutgers Univ.; Membership, C. Hovey, Eastern States Farmers Exchange, W. Springfield, Mass.; Public Relations, R. A. Peters, Univ. of Conn.; and R. H. Beatty, American Chemical Paint Co. as chairman of the Awards committee.

COTTON STATES ESA

(*From Page 55*)

users. "We mustn't forget," he observed," " that the majority of our farmers are apparently not yet convinced that pesticides are a good investment. Less than 15 per cent of the nation's cropland is protected by pesticides, although this is the finest and least expensive insurance the farmer can buy. Even in the cotton growing areas, where the tonnage of insecticides is high, it would be rare to find a section where all the growers regularly use pesticides. This seems almost incredible, in the face of the abundant evidence that there are now many dusts and sprays that give safe, economical protection against cotton insects, and pay for their cost in the higher yield per acre. Yet the fact remains that the whole pesticide industry is selling much less than its potential in the one area of the United States that is most alert and educated on the value of insect control.

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"Not only are there too few farmers using these materials, but many that do use them are not using them in sufficient quantity or in the most effective manner to derive the maximum amount of return from their investment in agricultural chemicals. For example, the average yield per acre in certain areas of South Carolina was 400 pounds of lint. In these same areas, under experimental conditions, the proper use of pesticides and fertilizers gave over 1,600 pounds. With correct management and reasonable pest control, it is possible and economically feasible to increase the yield by at least one-third, in this and other cotton-growing areas.

"We must keep on telling the farmer that pest control is the way to higher yields. Today, he spends money for fertilizer and then neglects to spend a little more cash for the recommended pesticides that could help him harvest a good crop.

"It would appear that we have to sell the value of pesticides to many farmers, just as much as we have an educational job to do with the consumer of food products."

Mr. Mayfield also discussed the important problem which annually faces manufacturers of pesticides . . . of getting adequate distribution of pesticides in advance of the consuming season, so that needed stocks will be on hand for application, when and where infestations occur. He pointed out that "Even though we now have adequate manufacturing facilities, the basic chemicals and a reasonable quantity of stocks of pesticides on hand, we must still have efficient distribution which requires the cooperation of the dealer selling these products and of the grower who uses them. Due to the very seasonal nature, and the unpredictable size of infestations, our industry has found it necessary to maintain unusually heavy stocks of agricultural chemicals when compared with other phases of the chemical industry. During the war years and immediately following, industry, agricultural leaders, farmers and dealers all worked together to have an available stock of crop protectants on hand in advance of the season to handle at least part of the requirements which could be anticipated. During 1953, this early purchase program broke down completely, and several serious incidents occurred in which heavy outbreaks of pests in some areas of the United States rapidly depleted dealers' stocks and serious crop damage was imminent. The industry took extraordinary means to replace those stocks on very short notice and managed to prevent severe losses to crops in those areas. We were able to do this because we entered the 1953 season with the largest inventory in the history of our industry. Such is not the case in 1954.

"The oversupply of chemicals which built up during 1952 and 1953 has caused manufacturers to take a thorough look at the situation. They are approaching the 1954 season with a great deal more caution than was displayed in the past two years.

"It is time again to reinstate the 'Buy Early' program and here is where the entomologist can be of real help to the farmer and to the pesticide industry. Cotton as a crop, of course, requires the largest tonnage of insecticides of any crop of the United States. The movement of insecticides in this area determines to a large extent the sales and profit picture for the entire industry. Entomologists, working with the grower should make sure that he has at least a part of his pesticide requirements on hand at the beginning of the season."

More than 40 technical reports were presented during the three-day meeting; these covered a wide variety of work being carried on within the area covered by the Cotton States Branch. Some of the subjects covered control of cotton insects, subterranean insects, house flies, soil insects, stored grain pests, ornamental insects, fruit insects and insects attacking tobacco, sugarcane, rice and corn.

The program committee for the 1954 meeting consisted of: Dr. W. G. Eden, Auburn, Ala., chairman; H. S. Mayeux, Jacksonville, Fla.; C. F. Smith, Raleigh, N. C.;

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H. F. Schoof, Savannah, Ga.; and R. J. Kowal, Gulfport, Miss. Local committee on arrangements was headed by W. G. Bruce, Gulfport, Miss.; and included, C. C. Fancher, F. J. Bartlett, and J. P. Toffaleti. J. F. White, Jackson, Miss., was in charge of publicity.

TVA '53 REPORT

(*From Page 35*)

the situation, weight would have to be given to the different tax status of TVA as compared with private enterprise.

Actually, however, TVA's need to justify its existence by showing a profit is largely irrelevant, no matter how they keep their ledgers. What is more important, as TVA completes its first twenty years of operation, is whether the TVA program contributes enough to technological advancement and to human welfare to justify its continuance at considerable expense to the taxpayers. And in figuring this intangible balance sheet, the value of TVA as a standby source of munitions in wartime must of course be weighed heavily.

With a natural dislike of government competition, which all private industry shares, the fertilizer industry has perhaps been somewhat skeptical in the past of TVA's operations. We get the impression, however, that there has been somewhat of a softening in this attitude in recent years,—at least in some quarters,—and there have been good reasons for this more tolerant view.

TVA's contribution to the production of nitric phosphate fertilizers and the impetus it has given to the growing trend toward higher analysis fertilizers have been worthy contributions. It should be noted, of course, that TVA frequently relies on industry members and USDA for help in carrying out its research.

Recent pilot plant tests at TVA with "wet process" phosphoric acid may have ultimate benefit to the industry in cutting the cost of phosphoric fertilizers, while making effective use of phosphate reserves.

No matter how beneficial the work of TVA is, however, the Authority should keep in mind its basic function of research,—and steer clear of competition with industry whenever possible. Two statements in the recent report indicate that TVA may have a growing awareness of this obligation. In discussing concentrated superphosphate, the report states: "TVA originally had planned to discontinue production in the last fiscal year but continued to produce the material because of the urgent need and demand for high analysis fertilizers." The industry should have an opportunity to test the sincerity of this implied pledge in the near future, as ample concentrated superphosphate will shortly be available from private industry to satisfy demand.

Elsewhere in the report it is noted that TVA's advances "have been accompanied and achieved by methods calling for less Federal control, and more state and local responsibility." To this pledge of less Federal control, industry will gladly say ——"Amen."

In the final analysis, if TVA will stay within its own boundaries, and do a good job within them, if it will adhere to the principle of operating with the minimum possible competition with private industry, fertilizer manufacturers will stand to benefit on an over-all basis from its research, and from its status as a promoter of increased consumption of plant foods.

ILL. TRAINING SCHOOL

(*From Page 79*)

forms of nitrogen materials . . . kinds, formulation, etc. of mixed fertilizer solutions.

Dr. Wendell Bowers, Univ. of Illinois, discussed equipment for application of liquid fertilizers, and particularly the question of corrosion of equipment. He indicated that cleaning equipment everyday will cause more corrosion than leaving a sprayer full of solution; but advised that the sprayer be thoroughly cleaned with a detergent when it is not to be used for an extended period.

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Reviewing the problems and control of field crop insects for Illinois, J. H. Bigger, Illinois Natural History Survey, Urbana, reported that toxaphene gave satisfactory control of cutworms; at two pounds per acre, it also controlled the bean leaf beetle; .25 pounds of dieldrin per acre gives good control where chinch bugs and flea beetles both infest the fields; and grasshopper control is obtained with 1.5 to 2.0 pounds of toxaphene or 1.0 pounds of chlordane. Two to three ounces of aldrin or dieldrin did well where grass hoppers were not migrating.

Other reports dealing specifically with control of giant foxtail, Canada thistle, quack grass, brush, flies, etc., were presented by F. W. Slife, Univ. of Illinois; K. P. Buchholtz, Univ. of Wisconsin; Norman Gannon Illinois Natural History Survey; and L. L. Coulter, Dow Chemical Co., South Haven, Mich.

Still another feature of the Urbana meeting, was a movie "500,000 to 1," dealing with the science of entolomolgy, and produced by Sinclair Oil Refining Co.★★

NW PEDDLERS CLINIC

(*From Page* 54)

phytotoxic, non-toxic to warm-blooded animals and yet highly toxic to wheat-smut spores. These may find a place in the Pacific Northwest, especially in those sections where there is no seedling blight.

Insects Affecting Man and Animals

"Mosquito problems are much different in the Northwest than in the Southwest and East," stated Gaines W. Eddy, USDA, Corvallis, Ore. The horn fly situation is practically the same the country over. Recommended residual insecticides still work on both dairy and beef cattle. While no reports of resistance have yet come in from the Northwest, there have been several instances reported in Florida.

Rotenone is still the only material recommended for control of cattle grubs, but in preliminary tests certain phosphate compounds now appear promising. Malathion-sugar baits are working well for housefly control. Dr. Eddy stated that it was encouraging to note that where houseflies had shown resistance to phosphate pesticides, they have not continued to develop high levels of resistance, such as have occurred with chlorinated compounds.

New State Recommendations

Oregon has had a high incidence of strawberry yellows which calls for an aggressive control program on the strawberry aphid. R. W. Every, Oregon extension entomologist, said parathion and TEPP will be recommended for control of the aphis vector. Chlordane and aldrin have been cleared for carrot rust fly control after flavor evaluation tests by the Dept. of Food Technology.

Heptachlor, dieldrin and aldrin will be recommended as soil application measures for control of tuber flea beetle on potatoes. Aldrin, lindane or heptachlor are recommended for larval control of alfalfa weevil. Oregon plans to issue a livestock pest control leaflet soon.

Washington recommendations will be changed only slightly stated David H. Brannon, Washington extension entomologist. Main changes will be for use of systemics for control of aphis and mites on non-bearing apple, pear and stone fruits. On small fruits they now have a leaflet out on control of strawberry root weevil with chlordane or aldrin. Malathion will be recommended for control of lecanium scale on cranberries. Dieldrin will be recommended as a pre-bloom treatment on alfalfa for lygus and alfalfa weevil control.

Idaho will recommend a Dieldrin or Heptachlor dust, or Chlordane, Heptachlor or Dieldrin spray stated R. W. Portman, Idaho Extension Entomologist. Time of application is important, and applications should be made as early as it is possible for growers to get on the field.

The chairman selected for 1955 was Mr. O. B. Hitchcock, U. S. Industrial Chemicals Co., Division of National Distillers Products Corporation, Portland, Oregon ★★

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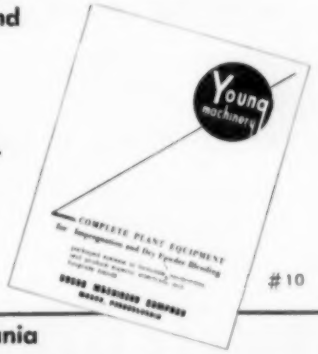

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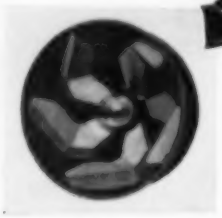

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SOUTHERN CONFERENCE

(*From Page 81*)

three pounds of the active ingredient, 3 - (3,4-dichlorophenyl)-1,1-dimethylurea. The trademark "Telvar" will apply to industrial herbicide formulations.

The chemical developed in the laboratories of the Dow Chemical Co., Midland, Mich., for use on brush in cotton areas, has been trademarked "Silvex," and contains as its active ingredient trichlorophenoxypropionic acid. Dow representatives pointed out that "Silvex" should be used carefully, but that with careful use it offers promise of satisfactory brush control. It is reported to have killing powers about equal to 2,4-D but with less drift hazard to cotton.

Other new herbicides discussed at the meeting included "Natrin," which shows promise as a pre-emergence herbicide, and is not damaging to plants when applied to foliage; ammonium nitrates plus wetting agents, show promise as a dual purpose herbicide fertilizer. It was pointed out also, that urea compounds will be made available for commercial use within the year, however, these are not being recommended by all states.

J. C. Davis and G. C. Klingman, North Carolina Experiment Station, Raleigh, N. C., reviewed studies on ammonium nitrate, wetting agents, 2,4-D and "DuPont M" for weed control in corn. They indicated that dinitro applied as a post-emergence, over the top, spray is injurious to corn and fails to give satisfactory weed control. Ammonium nitrate applied as a directed spray is fully as effective a fertilizing material as the solid form, they reported. With no apparent injury to the corn, 3-(3,4-dichlorophenyl) - 1 - methylurea gives weed control one to two times as long as 2,4-D.

More than 300 delegates took part in the sessions (several of which were held concurrently); and exhibits of the most recent advances in farm equipment and chemicals for weed control.

CALIFORNIA WEED CONF.

(*From Page 81*)

versity of California, indicated that "without exception all troublesome rice weeds are retarded as the depth of water increases. As long as this depth is not increased to a depth detrimental to rice growth, water depth becomes an effective weed control practice.

Still other reports at the conference pointed out that: (1) the ester formulations of 2,4-D or 2,4,5-T have proved effective for the control of camelthorn when used several times during the growing season and over a period of at least two years or more; (2) effective control of halogeton has been obtained with the low volatile ester of 2,4-D at the dosage rate of two pounds of acid equivalent per acre in 50 gallons of water; (3) 95 to 98 per cent effective results are obtained in control of Russian knapweed, using 1½ pounds sodium chlorate or 3.0 pounds polybor-chlorate or 3/5 gallons of chlorax liquid per 100 square feet.

Mr. R. Pryor, field supervisor of weed control of the California State Department of Agriculture, was chairman of public relations and publicity.

•

ACS Meets March 24 in Kansas

The latest progress in chemical advances against the diseases of farm animals is among the subjects to be reported at the American Chemical Society's 125th national meeting, which will be held in Kansas City, Mo., March 24 to April 1.

Five thousand chemists and chemical engineers from all parts of the United States are expected to attend the meeting and participate in sessions conducted by 19 of the Society's scientific and technical divisions. The Kansas City Section will be host to the visiting chemists. Dr. Leonard V. Sorg of the Standard Oil Company, Ind., is general chairman.

The meeting will follow an experimental pattern, extending over parts of two weeks, with registration opening Tuesday, March 23, in the Municipal Auditorium. The first sec-

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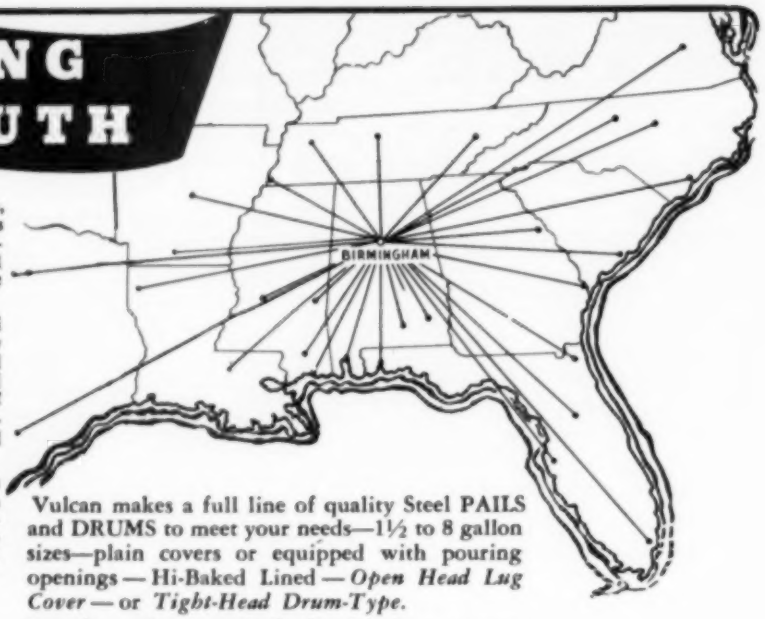

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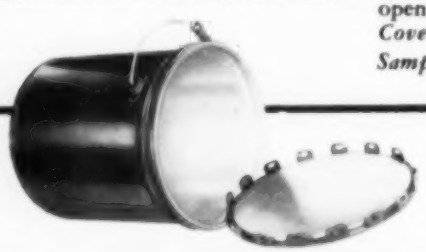

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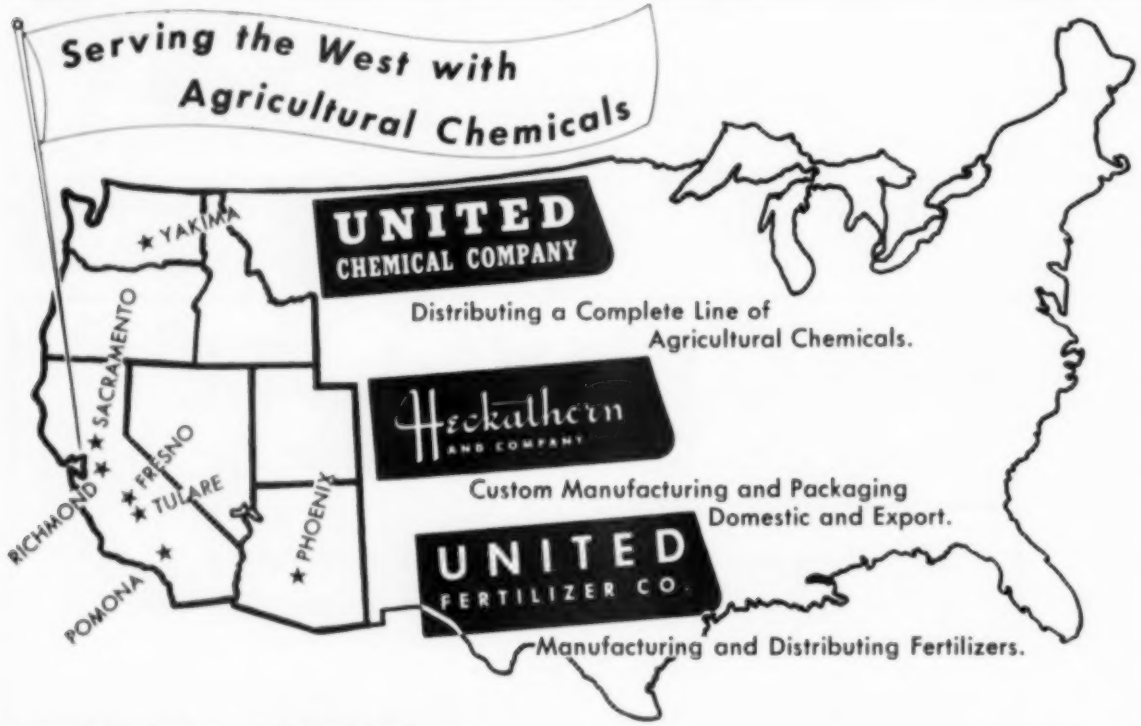

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tion of the meeting, scheduled for March 24, through March 27, will be sponsored by the Divisions of Agricultural and Food Chemistry; and other sections of ACS.

FUNGICIDE ACTION

(*From Page 68B*)

indicate that temperature, within the above range, bears no effect on the inhibitory action of HCB on spore germination other than indirectly on the rate of sublimation.

An attempt was made to learn whether the detrimental effect on spore germination exhibited by HCB is fungistatic or fungicidal. Some plates containing spores that had been exposed to HCB vapor for three to seven days were allowed to incubate in the open. Results were inconsistent in a number of tests, but indications were that viability of these spores was related to length of exposure, temperature at exposure time, and amount of HCB used. It can be stated only tentatively that the spores of both *T. caries* and *T. foetida* were unable to germinate when they had been held in the jars with 150 mg of HCB for seven days at 20° C. In other words it seems that the inhibitory effect of HCB may finally become fungicidal if the spores are exposed to it for a prolonged period. It is worthy of note that spore germination in the presence of HCB was mostly atypical and the production of both primary sporidia and basidiospores was greatly suppressed.

Although hexachlorobenzene sublimes at room temperature, the degree is almost negligible. The vapor pressure of HCB at 20° C, as calculated from the formula of Sears and Hopke, was 1.089×10^{-5} mm of Hg. Similarly, the vapor pressure of HCB at 5°, 10°, and 15° C was found to be 1.429×10^{-6}, 2.871×10^{-6}, and 5.662×10^{-6} mm, respectively. The gaseous volume percentage is equal to $\frac{p}{P} \times 100$, where p is the partial pressure of vapor, and P the total pressure. Since the total pressure P differed but slightly from the normal barometric pressure of 760 mm, the value P was regarded as equal to 760 mm. in all calculations. The vapor concentration of HCB at 20° C therefore would be 14.33×10^{-7} percent.

If the free air space in the Petri dish, exclusive of the volume of agar and vial, be 85.43 ml, the theoretical amount of HCB required to give such a maximum vapor concentration of 14.33×10^{-7} percent at 20° C as calculated from the gas law would be 1.45×10^{-5} mg. The extraordinary action on *Tilletia* spores by this amount of HCB vapor seems very striking.

Theoretically only 1.45×10^{-5} mg. of solid material of HCB was needed to inhibit spore germination in a 10 cm Petri dish at 20° C. It is doubtful, however, that this equilibrium can ever be reached under practical conditions. It was found that 10 mg of HCB was required to inhibit spore germination completely under these conditions. When smaller

(*Continued on Page 145*)

LOUISIANA CONFERENCE

(*From Page 83*)

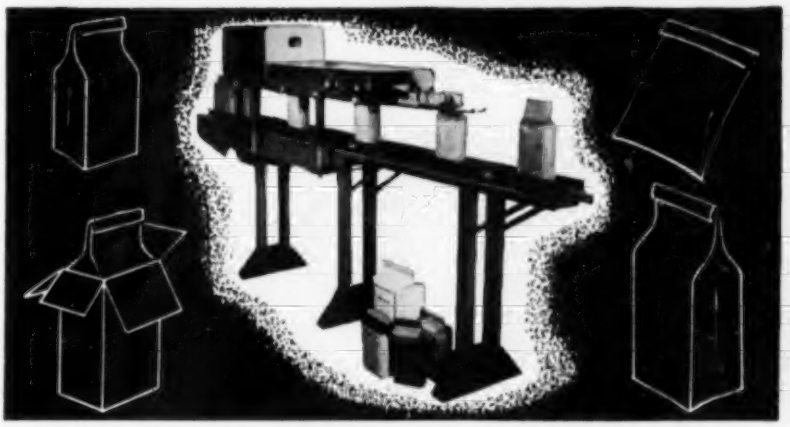
value of granular materials. 1,000,000 acres of corn will be treated with granular insecticides in 1954. It was pointed out that results are sometimes erratic, because of variability of the soils, condition of the soil, moisture and other factors.

Leyburn F. Lewis, U.S.D.A., and Edward Broadus, Niagara Sprayer and Chemical Co., discussed livestock pest control and stated that there have been few advances in this field during the past 8 to 10 years. Flies are of course showing resistance to DDT and methoxychlor, but malathion is an effective substitute. Dipping and spraying of livestock was discussed by Broadus, who stated that spraying offers more advantages than dipping for pest control.

L. C. Murphree, Coahoma Chemical Co., led an important panel

(*Continued on Page 145*)

FRY BAG SEALER



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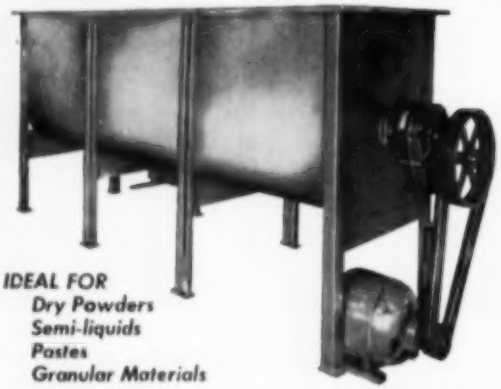

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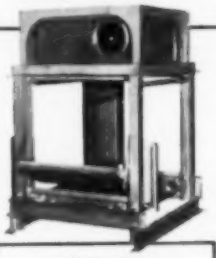

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LOUISIANA CONFERENCE

(*From Page* 141)

on some causes of poor results from insecticide applications. Discussions were given by Dr. J. S. Roussel, Louisiana Agricultural Experiment Station, C. W. Kennedy, manager of Ashley Plantation, Tallulah, and Roy Pilkinton, crop dusting pilot. Roussel named the important considerations in insect control, while Kennedy commented that the farmer must know the insects involved, know when to begin poisoning, have accurate field checking and stay on a regular schedule of poisoning. Pilkinton observed there is always a need for reliable pilots or applicators, and agreed that flagging of fields is necessary, although he admitted that he had formerly not thought so. Poor quality or old liquid sprays sometimes give trouble, he added.

Supervised control was discussed by Kirby L. Cockerham, Louisiana Extension entomologist, Paul Rosenzweig and Truman Thomas, commercial cotton checkers. Cockerham stated that this service needs expanding not only on cotton, but to other crops like sugar cane. The demand for field checkers exceeds the supply, he pointed out, and many cotton farmers do not trust their own knowledge of insects or their judgment on when or when not to poison. Rosenzweig and Thomas described methods of checking fields, problems encountered, prices charged for the service and other matters relating to the subject.

Another new subject on the program this year was defoliation and insect control, with C. B. Haddon, superintendent of Northeast Branch Experiment Station, as leader and S. L. Calhoun, Agricultural Chemicals Co., B. H. Sellers, Thompson-Hayward Chem. Co., and R. C. Gaines, B.E.P.Q., completing the panel. Haddon announced that 70,000,000 pounds of defoliant were used in 1953 in cotton producing states, but added that more research is needed, since ½ bale cotton per acre was lost in fields that were defoliated too early. Calhoun spoke on the physiology of the plants in relation to defoliation, and advised that defoliation should be done when cotton is mature or has "cut out" of production. Growing plants will not defoliate satisfactorily. Sellers spoke on various defoliants, and stated that 40% pentachlorophenol can be applied for $3.00 per acre. Gaines spoke principally about the effect of defoliation on the insects present. Boll weevils leave defoliated fields and may go into hibernation in poor condition as a result of the defoliation. All leaf feeding insects, such as aphids, leaf worms and spider mites would be eliminated.

Research and control of cotton insects during 1953 was discussed by C. E. Smith, Dr. J. S. Roussel and Dr. L. D. Newsom of the Louisiana Agricultural Experiment Station and R.C. Gaines of the B.E.P.Q. Research work was discussed by all, and recommendations for control in 1954 were given. Gaines reported that practically all of the various cotton poisons kill beneficial insects. He also indicated that cotton leaf worm and spider mites are now showing resistance to some insecticides. The only changes in cotton insect control recommendations for 1954 were the adding of endrin for the control of boll weevils and bollworms, and demeton (Systox) for control of aphids and spider mites.

H. L. Alford, U.S.D.A., Pink Bollworm Project leader in Louisiana, gave an illustrated lecture on the pink bollworm and measures for control. He told of bollworm damage in Texas and warned that strenuous efforts must be exerted in Louisiana to prevent severe loss. Eight parishes in Louisiana were listed as having become infested in 1953. C. E. Smith told of plans for research to meet the problem in Louisiana.

The 5th Louisiana Insect Control Conference will probably be held in Monroe or Baton Rouge next year.

FUNGICIDE ACTION

(*From Page* 141)

amounts of HCB were used, the percentages of spore germination increased proportionally. Many of these spores may have germinated before a threshold vapor concentration in the dish was reached. In the application of this fungicide, particularly to the soil, it is desirable that sufficient HCB material be used to release a vapor concentration that will inhibit spore germination in a few days at a particular temperature range.

From the results obtained in the foregoing experiments, it can thus be concluded that the effective control of dwarf bunt as well as common bunt of wheat by HCB is primarily due to the inhibitory action of the vapor on spore germination. As HCB sublimes only slightly at room temperatures, the threshold vapor concentration necessary to complete inhibition of spore germination has not been determined. From calculated data it appears that the possible maximum concentration of HCB at 20° C cannot be more than 14.33×10^{-7} per cent. In field practice, the efficiency of control is dependent on the concentration of vapor given off by the HCB in the soil. The rate of sublimation may be affected by the method of application, the nature of filler, the temperature, moisture, and texture of the soil, and many other factors. It appears desirable that research on the action of HCB be continued.

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Tale Ends

A RAPID game of "Musical Chairs" seems to be going on among some of the top personnel in the agricultural insecticide field of late. Every time we look around, some other familiar face is out of his own chair and in to someone else's. Up to this point, however, the game is not proceeding with the ruthless finality of the parlor version. In case you have forgotten, the party version of "Musical Chairs" involves sneaking out one of the chairs from time to time, so that in the final analysis some one always ends up with no place to sit. In our current version of the game the number of chairs remains the same, and the un-chaired seem eventually to end up sitting down somewhere else. Some of the chair seats are still warm, too.

* * * * *

The "trade not aid" boys are taking some heavy pot shots currently at the historic protective tariff policy of the U. S. Before they start to do anything drastic about rates on chemicals, however, we would like to remind them that a strong, healthy and profitable chemical industry is one of the nation's strongest bulwarks,—perhaps co-equal in importance with our top position in steel as a prime factor in securing the defense of the nation. Senator Styles Bridges phrased the whole proposition rather well in a recent address before members of the S.O.C.M.A. when he recognized that "American industrial capacity," which incidentally was built up under the protective tariff system, "provides the great bulwark of strength which makes the United States feared and respected." May we never weaken this bulwark!

* * * * *

And this threat of increased competition to the American chemical industry from a revived German industry, — or from chemicals produced by other European countries — as a case in point witness the red potash invasion of 1952 — apparently has a number of American chemical companies definitely concerned. We see this perhaps as the reason behind the recent decision of some of the large factors in the chemical pesticide field to go after the consumer market more aggressively. Whether the basics are produced in the U. S. or made abroad and imported, they may have the feeling that they will be in better position to guarantee some profit on the way to market if they established their own consumer brands. This trend, if continued, could mean added competition for the mixer and formulater, and a natural reluctance on the part of the same mixers and formulators to buy their raw materials from firms who compete with them. Selling both sides of the street has long been a touchy business.

* * * * *

It's good to hear that Bill Chace, who has hundreds of friends in the fertilizer industry by way of his seven years with NFA, is back in the agricultural chemicals fold at least partly. Bill's new post is assistant public relations director of the Manufacturing Chemists' Association, as reported in this issue.

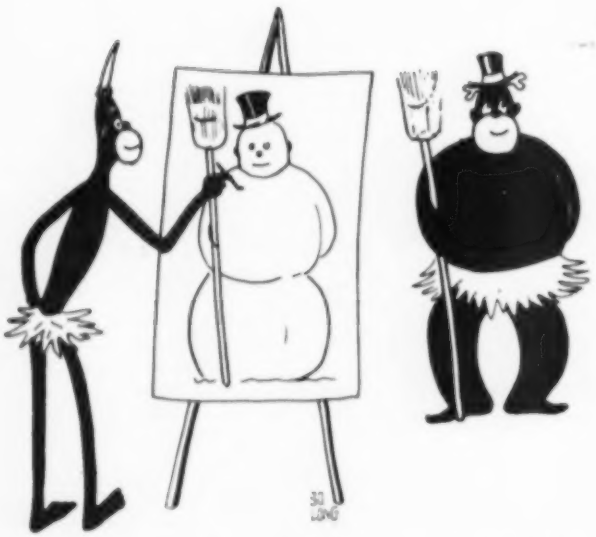
* * * * *

Add new faces of '54: Around the AC editorial offices it's Hamilton Carson, recently of "Farm Chemicals," Philadelphia, who is the latest member of "Agricultural Chemicals'" editorial staff. You'll be seeing him around.

* * * * *

The ladies are again showing their influence in what was a "man's world." We've recently heard of the successful ventures of Miss Dorothy L. Piper of Chicago as a chemical saleswoman. Formerly a secretary with Phelps Dodge Refining Co., she now does a business of more than $750,000 with farmers.

Climate . . .



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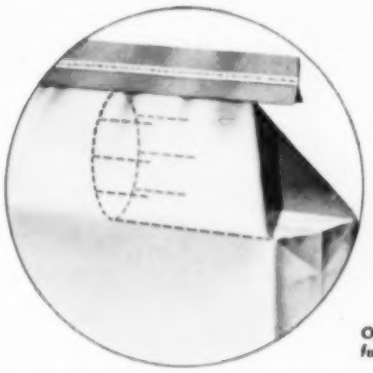

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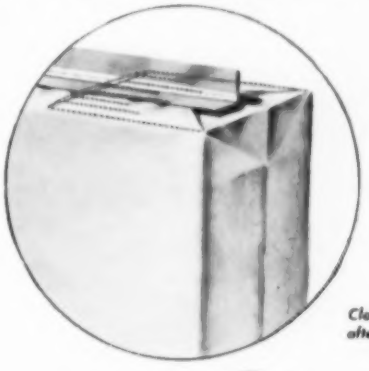

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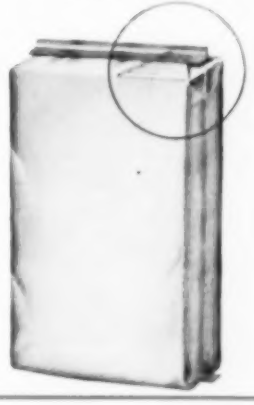

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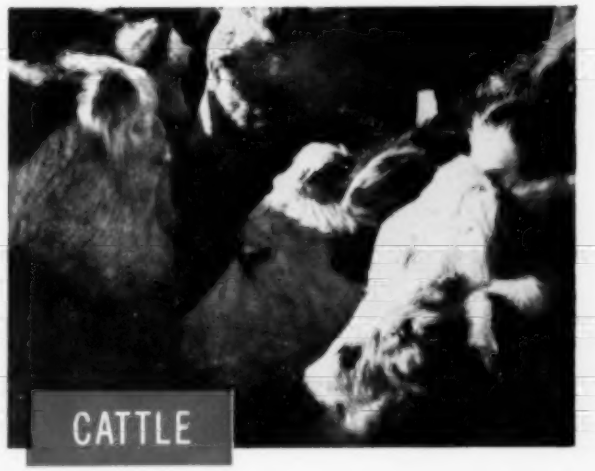

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